WHITE RIVER SHALE OIL CORPORATION

WHITE RIVER SHALE PROJECT

BIENNIAL PROGRESS REPORT

MARCH, 1982 – MARCH, 1984

BIENNIAL PROJECT REPORT

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FEDERAL PROTOTYPE OIL SHALE TRACTS Ua AND Ub

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1.0 WHITE RIVER SHALE PROJECT PROGRESS REPORT - INTRODUCTION AND BACKGROUND

The White River Shale Project (WRSP) involves the development of Federal Prototype Oil Shale Lease Tracts Ua and Ub in northeastern Utah. The tracts were acquired in 1974 by the project owners - Phillips Petroleum Company, Sohio Shale Oil Company, and Sun Shale Oil Company. The tracts are located in the eastern portion of the Uinta Basin in Uintah County, south of Bonanza and contiguous to the White River, which borders the tracts on the north.

The WRSP plans call for a staged development in three phases with appropriate project reviews and decision points throughout the development. Phase I comprises mining, oil shale retorting, and shale oil upgrading facilities designed to generate specific information on orebody characteristics, retorting and shale oil processes, and environmental protection. Up to 30,000 tons per day of oil shale will be mined in this phase. Phase I is designed to produce approximately 16,500 barrels per stream day of upgraded shale oil.

Modified room-and-pillar underground techniques will be used at the WRSP to mine the oil shale. Mined shale will be crushed and screened to produce the required size ranges. After crushing, the shale will be processed in surface retorts. As currently planned, Phase I will consist of two Unishale B retorts, which have been licensed to the sponsors by Union Oil Company of California. The resultant shale oil will then be upgraded to a synthetic crude oil onsite.

As currently described in the Detailed Development Plan (DDP), Phases II and III would involve expansion of shale oil production to levels of approximately 57,000 and 106,000 barrels per stream day, respectively.

The White River Shale Oil Corporation (WRSOC) is based in Salt Lake City, Utah, and is responsible for managing and operating the project on behalf of the three project owners.

Up until March 1, 1982, the terms, obligtions and conditions of the leases to Tracts Ua and Ub had been suspended under the provisions of a Court Injunction Order effective May 31, 1977. On March 1, 1982, this injunction was lifted and the lease terms put back into effect. This action signaled a major milestone after years of concern regarding the title to Tracts Ua and Ub. While clouds still existed on that title in March 1982, the Owners of the WRSP decided to press on with development activities even in the face of these lingering risks. The most notable of these risks involved the assertion by the Ute Indian Tribe to ownership of what had once been the Uncompahgre Indian Reservation. Tracts Ua and Ub reside within what had at one time been the exterior boundaries of this reservation.

Clearance of other significant title questions, however, encouraged the owners of the WRSP to lift the injunction and proceed ahead on the basis of the Detailed Development Plan (DDP) that had been submitted to the Oil Shale Project Office (OSPO) in 1981. This DDP was approved March 2, 1982, and since that time it has been updated as plans have evolved. Through March 1, 1984, activities have proceeded in compliance with the DDP and in accordance with the Due Diligence Requirements of the leases to Tracts Ua and Ub.

This progress report describes the tract development activities which have been initiated at the WRSP site during the period covering March 1, 1982 through March 1, 1984. The report is submitted to the OSPO in fulfillment of the requirements of Section 16(b) of the Oil Shale Leases for Tracts Ua and Ub.

WRSOC has also prepared and submitted to OSPO two additional reports which describe the results of our Environmental Monitoring Program during calendar years 1982 and 1983. These reports were as follows: "1982 Progress Report, Environmental Program, White River Shale Project", and; "1983 Progress Report, Environmental Program, White River Shale Project".

2.0 EXECUTIVE SUMMARY

Several significant accomplishments were made in regard to development of Federal Prototype Oil Shale Lease Tracts Ua and Ub during the period March 1, 1982 to March 1, 1984. These are described in this section by the White River Shale Oil Corporation (WRSOC). The WRSOC is responsible for the management and operation of development programs associated with the White River Shale Project (WRSP). The WRSP is owned by Phillips Petroleum Company, Sohio Shale Oil Company, and Sun Shale Oil Company and was formed for the purpose of developing Tracts Ua and Ub.

On March 1, 1982, the Court Injunction Order concerning Tracts Ua and Ub was lifted and the terms of the Federal Oil Shale Leases for these tracts were put back into effect. The injunction had been in effect since May 31, 1977. The Detailed Development Plan (DDP) for the WRSP was approved by the Oil Shale Project Office (OSPO) on March 2, 1982 and since that time, the DDP has been updated as development plans evolved.

Subsequently, during 1982 the WRSP field activities went from an environmental monitoring mode to a major construction effort associated with the development of the Phase I mining facilities. To accomplish this goal, WRSOC employed the expertise of three engineering firms: The Ralph M. Parsons Co.; J.S. Redpath Corp., and; Cleveland Cliffs, Inc.

Parsons was assigned the design responsibilities for the undergound crushing and maintenance facilities (and the mine related surface facilities that would be constructed in 1982 and 1983), and the mine definitive cost estimate. J.S. Redpath was assigned the engineering responsibilities for the

shafts, the decline, and associated facilities. Cleveland Cliffs was assigned design responsibilities for the underground mine, including equipment complements and operating manpower for the mine definitive cost estimate. The work of these three organizations, managed and directed by WRSOC, led to the completion of the design construction drawings for the decline and shaft as well as several mine support surface facilities. In addition, a definitive cost estimate, including operating and capital costs for a Phase I mine with a capacity of 30,000 TPD was completed.

Ventilation Shaft mobilization and construction began in late 1982 and construction was completed in December of 1983. In the late fall of 1982, mobilization also began for the construction of the production decline. Actual excavation of the decline portal began in November of 1982. By March of 1984, the upper leg and the "dog leg" turn of the decline were completed and the lower leg was advanced 1550 feet.

During the last half of 1982, several contracts were awarded to various construction firms for site preparation and grading, site road development, mine services building, water treatment/sewage treatment facilities, a telephone microwave system and other facilities required for the support of the mine development program. These facilities were completed and became operational in late 1982 and early 1983. Construction of these surface facilities proceeded consistent with the DDP and were completed on schedule.

Also during 1982, the WRSP owners executed a license agreement with the Union Oil Company of California for the Unishale B Retorting Process. The license agreement allowed the project sponsors and WRSOC to assign six engineers to Union's operating staff at the Union Parachute Creek, Colorado,

facility to participate during construction, startup and initial operation. As of March 1, 1984, three WRSOC and three owner engineers were assigned to the Union retort startup staff.

The Union Oil Company Unishale B Pilot Plant in Brea, California, was operated from August 15, 1983 to September 30, 1983 with shale extracted from Hell's Hole Canyon, Utah near the WRSP property. This operation was conducted to provide data required to finalize the Unishale B process design for the WRSP feasibility study.

Batch testing of Utah Oil Shale was conducted between March 22, 1982 and October 1, 1982 by Dravo Corporation. These tests provided data which was subsequently used by WRSOC for a feasibility grade circular grate retort design.

In August of 1983, the Ralph M. Parsons Company was directed to begin work on a Feasibility Study for the WRSP. The goals of the Feasibility Study were as follows:

1. Provide the WRSP Owner companies sufficient technical definition and associated capital and operating costs to support the funding request for definitive engineering of the Phase I facilities.

2. Develop Phase II capital and operating costs to confirm the ecomonic viability of an expanded oil shale project as additional justification for expenditures on definitive engineering of the Phase I facilities.

3. Provide capital and operating costs for the Unishale B and circular grate retorting technologies.

The Feasibility Study was scheduled for completion in May of 1984.

In January 1983, culminating a thorough evaluation of available alternate upgrading technologies including Chevron, Gulf, Union and Amoco, the decision was made to utilize Union Oil Company's upgrading process information in the Phase I analysis of the project. License negotiations were suspended in early 1984 subject to preliminary results of the Feasibility Study.

On February 4, 1983, the Owners of the WRSP submitted an Information Response to the United States Synthetic Fuels Corporation's (SFC) Third Solicitation for proposals seeking financial assistance for commercial synthetic fuel projects. On February 24, 1984, the owners of the WRSP announced their intention to withdraw their request for financial assistance under SFC's Third Solicitation.

The sponsors did, however, continue to negotiate with SFC under the Third Solicitation. On February 24, 1984, the sponsors announced their intention to withdraw their request for financial assistance under the Third Solicitation. The sponsors felt that it was necessary to re-evaluate the overall plans for the WRSP to determine if changes were warranted to enhance the projects long term viability and consequently that it was inappropriate to continue further negotiations with the SFC.

Between March 1, 1982 and March 1, 1984, WRSOC continued its ongoing efforts to protect the natural environment of Tracts Ua and Ub. During construction activities, various measures were employed to control sources of air pollution while a runoff retention dam was constructed to prevent discharge of potentially contaminated waters to the White River. A non-hazardous, solid waste landfill was developed on tract to dispose of construction waste. During construction, various measures were implemented to control erosion and a Topsoil Management Plan was developed which deliniated methods and procedures for recovering and stockpiling topsoil from acreage disturbed by construction. In addition, those areas which would not experience further construction disturbances were reclaimed per the procedures discussed in the WRSP DDP. Also, $4.4 million in reclamation bonds was taken out by WRSOC in accordance with BLM and Utah Division of Oil, Gas and Mining regulations. As part of the Fish and Wildlife Management Plan lease requirements, WRSOC continued its study of interseeding selected areas of low plant density with native plant species in an attempt to improve range conditions. An Archaeological clearance was also issued for the WRSP which indicated that the WRSP construction activities would not impact any significant historic, scientific or aesthetic resources on Tracts Ua and Ub.

As of March 1, 1984, 109 separate permits/approvals were obtained for the WRSP; 97 of which were obtained in the March 1, 1982 through March 1, 1984 time period.

In 1982, the WRSP Envionmental Monitoring Program was given new direction by the publication of the Environmental Monitoring Manual (EMM). The approval of the EMM resulted in an expanded monitoring program during the period including 1982 through 1984. The WRSP Environmental Monitoring Program

addresses five areas: air quality; water quality; terrestrial biology; aquatic biology, and; information related to reclamation research. WRSOC has collected continuous environmental monitoring data on Tracts Ua and Ub since 1974.

Work continued during the reporting period on health, safety, and security programs. Dust control measures have been implemented during mine construction and permissible equipment was used in both the shaft and decline after excavation reached an elevation of 4661 feet. A certified emergency medical technician was on each construction shift and an emergency vehicle was provided on site to transport injured employees. The WRSP safety record has been excellent; especially when compared to other similar construction efforts. During the January 1983 through March 1, 1982 period, the WRSP contractors had 47 inspection days by MSHA. Citations issued can be classified as routine and relatively non-serious. WRSOC also implemented a set of General Security Procedures intended to protect workers as well as the WRSP construction effort.

Work continued during the March 1, 1982 to March 1, 1984 period to secure sources of water and power for development of Tracts Ua and Ub. On September 2, 1983, an agreement was signed with the State of Utah for use of up to 3,000 acre feet per year of water. Several important accomplishments were also made during the reporting period in regard to securing power. These included construction of a temporary power line and the execution of an electric service agreement between Utah Power and Light Company and WRSOC. However, a Public Service Commission ruling has stopped all activity. The ruling is currently under appeal to the Supreme Court of the State of Utah.

The workforce on the WRSP has been monitored continuously since March of 1982. In early 1982, WRSOC submitted a socioeconomic monitoring program to the OSPO. Since that time, socioeconomic monitoring reports have been prepared and distributed on a quarterly basis. Also, during 1983, a "Housing Master Plan" was prepared by WRSOC which discussed how and where the WRSP workers would be housed. In October of 1982, WRSOC submitted to the State of Utah and local governments in northeastern Utah and Western Colorado a document entitled, White River Shale Project Financial Impact Statement and Alleviation Plan. This document was submitted to satisfy the requirements of Utah code 63-51-10, commonly referred to as SB170.

During 1982, WRSOC continued it's recruitment activities, organizing a group of highly qualified management, professional and administrative personnel to effectively meet project management and corporate responsibilities. On December 31, 1982, WRSOC had a staff of 36 employees, an increase of 22 during the year. In December, 1983, WRSOC's staff reached 42. By February 29, 1984, staff was reduced to 40 as a result of voluntary terminations. In addition, preliminary Human Resource planning was completed in contemplation of developing a detailed 5-year plan that would outline Human Resource requirements through Phase I construction and operation.

WRSOC has prepared a Statement of Expenditures for the report period of March 1, 1982 through February 29, 1984. During that period, a total of $63,693,000 was spent on the development of Federal Lease Tracts Ua and Ub.

3.0 MINE DEVELOPMENT ACTIVITIES

3.1 Introduction

During 1982, WRSOC went from an environmental monitoring mode on Tracts Ua and Ub to a major construction effort associated with the development of the mining facilities for the Phase I portion of the WRSP. After extensive study, WRSOC concluded that the location of the plant site and associated Phase I mine should be near the centroid of the orebody contained within Tracts Ua and Ub. The final location chosen is slightly to the west of the centroid and closer to the Southam Canyon. Figure 3-1 presents the overall plot plan for the development of Phase I and indicates the location of the Phase I mine, as well as the location of associated mine support facilities. Figure 3-2 presents a detailed plot plan of the mine area while Figure 3-3 presents an artists conception of the overall Phase I Surface Facilities; including the location of the production decline entry, the service and ventilation shafts and the Mine Services Building.

In March of 1982, WRSOC's activities focused primarily on mine development, with the intent being to access the orebody in as expeditious a fashion as possible. At the same time, WRSOC wanted to complete a definitive cost estimate on the mining portion of the project for Phase I. In early 1983 it was decided to prepare a feasibility study for the construction and full operating costs associated with Phase I and Phase II of the WRSP (see Chapter 5 for additional details on the feasibility study). These four significant programs required a concerted engineer-

Figure 3-1

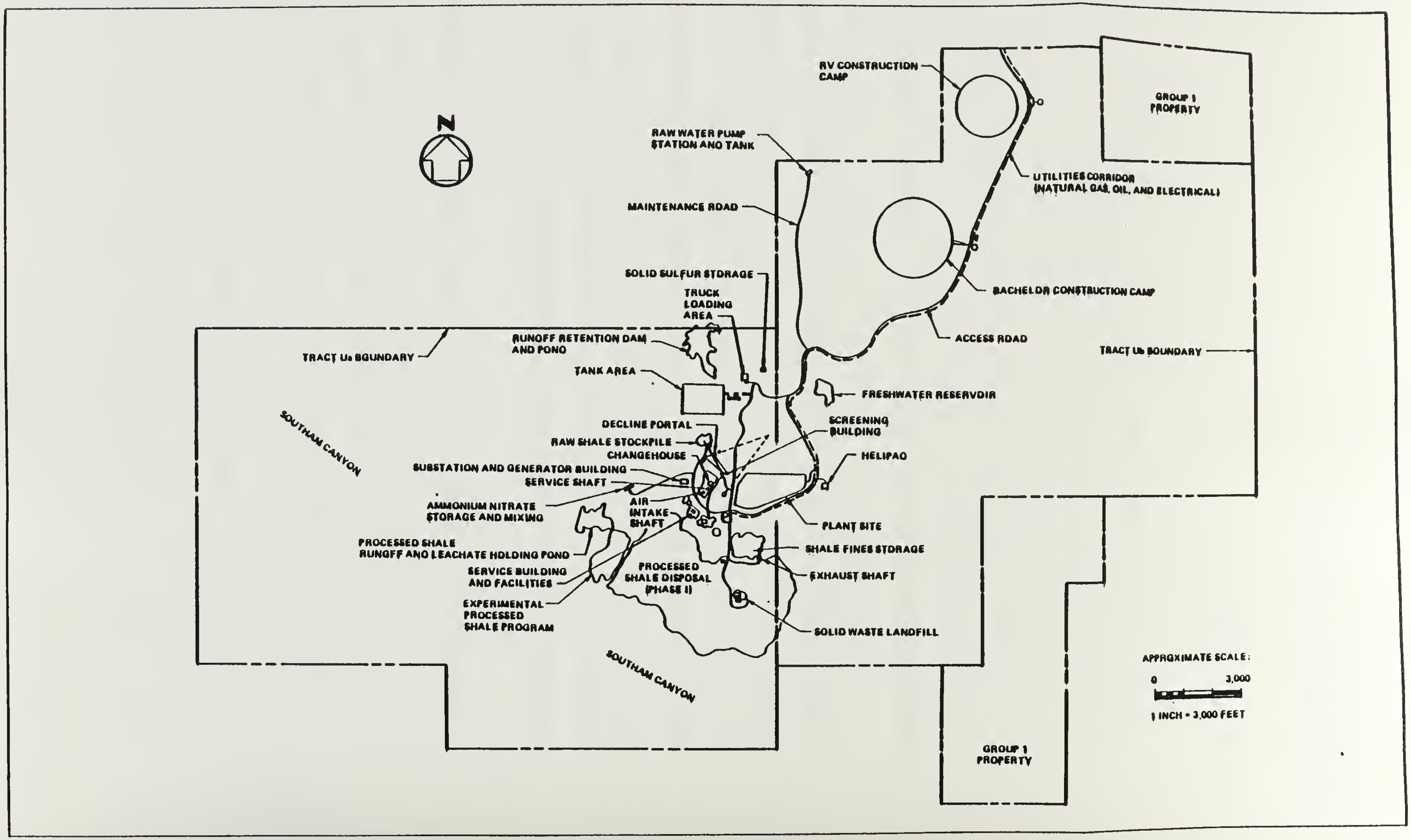
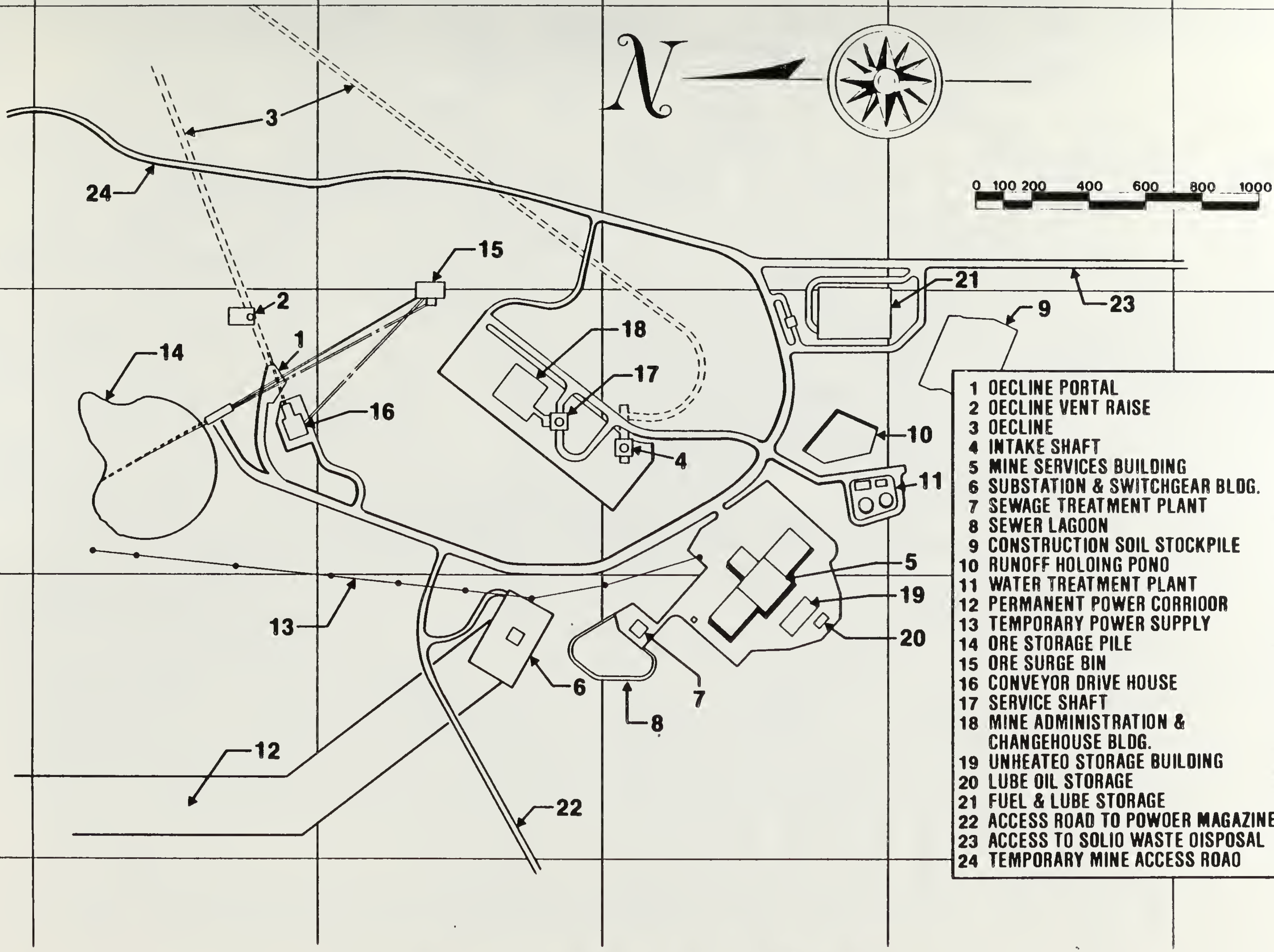
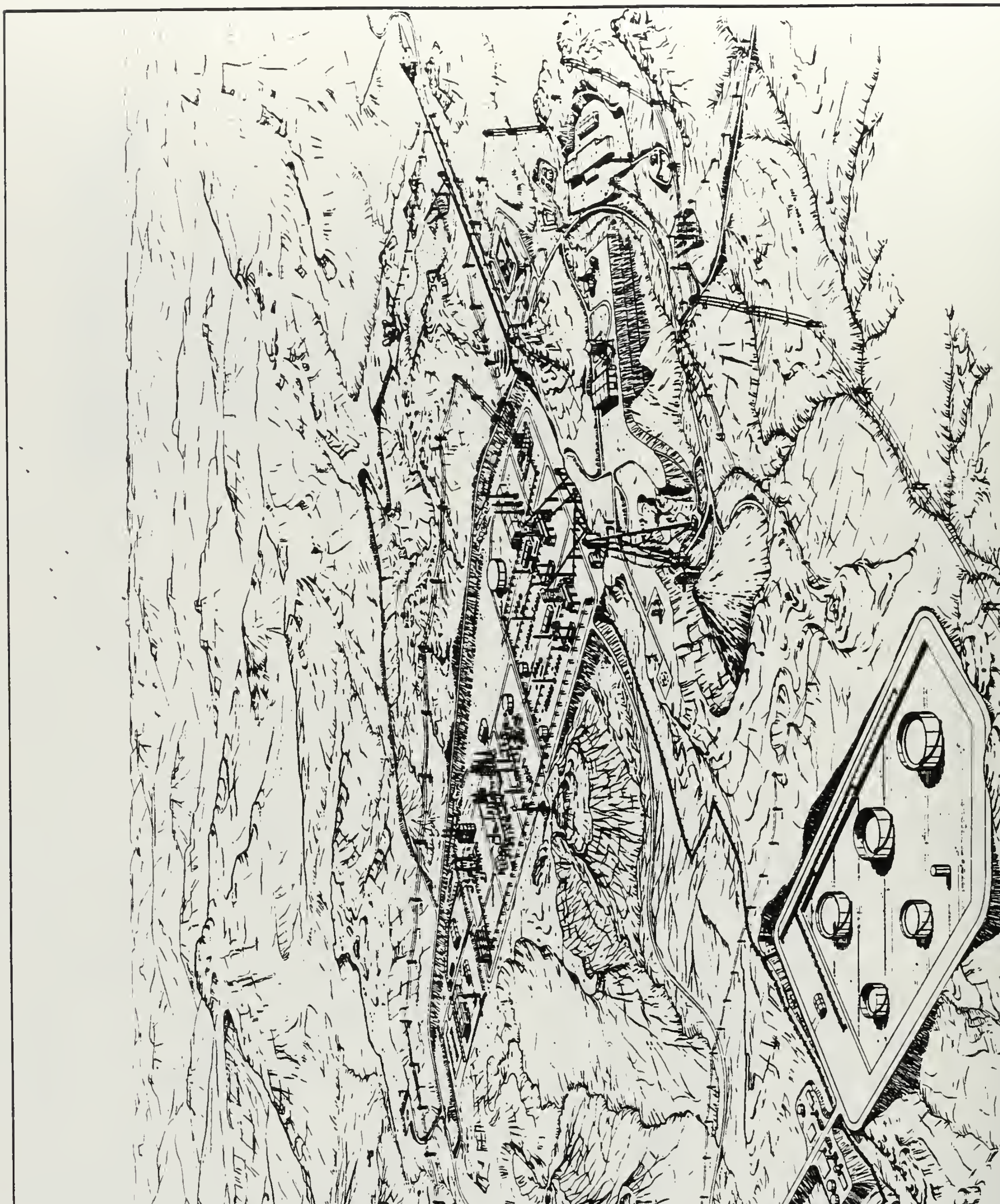

N
RV CONSTRUCTION CAMP
GROUP 1 PROPERTY
RAW WATER PUMP STATION AND TANK
UTILITIES CORRIDOR (NATURAL GAS, OIL, AND ELECTRICAL)
MAINTENANCE ROAD
SOLID SULFUR STORAGE
BACHELOR CONSTRUCTION CAMP
TRUCK LOADING AREA
ACCESS ROAD
RUNOFF RETENTION DAM AND POND
TRACT Ua BOUNDARY
TRACT Ub BOUNDARY
TANK AREA
FRESHWATER RESERVOIR
SOUTHAM CANYON
DECLINE PORTAL
SCREENING BUILDING
RAW SHALE STOCKPILE
CHANGEHOUSE
HELIPAD
SUBSTATION AND GENERATOR BUILDING
SERVICE SHAFT
AMMONIUM NITRATE STORAGE AND MIXING
AIR INTAKE SHAFT
PLANT SITE
PROCESSED SHALE RUNOFF AND LEACHATE HOLDING POND
SHALE FINES STORAGE
PROCESSED SHALE DISPOSAL (PHASE I)
SERVICE BUILDING AND FACILITIES
EXHAUST SHAFT
EXPERIMENTAL PROCESSED SHALE PROGRAM
SOLID WASTE LANDFILL
APPROXIMATE SCALE:
0
3,000
1 INCH = 3,000 FEET
SOUTHAM CANYON
GROUP 1 PROPERTY

Figure 3-2



MINE AREA PLOT PLAN

Figure 3-3



WHITE RIVER SHALE PROJECT
PHASE 1 SITE PLAN

ing effort by three engineering firms: The Ralph M. Parsons Co., J. S. Redpath Corp. and Cleveland Cliffs.

Parsons was assigned the design responsibilities for the underground crushing and maintenance facilities, the mine definitive cost estimate, and the mine related surface facilities that would be constructed in 1982 and 1983. J. S. Redpath was assigned the engineering responsibilities for the shafts, the decline, and associated facilities. Cleveland Cliffs was assigned design responsibilities for the underground mine, including equipment complements and operating manpower for the mine definitive estimate. The work of these three organizations, managed and directed by WRSOC, led to the completion of design construction drawings for several mine support surface facilities as well as the decline and shaft. In addition, a definitive cost estimate, including operating and capital costs for a Phase I mine with a capacity of 30,000 TPD, was also completed.

The following is a description of the specific areas of mine development design engineering and field construction that occurred between March 1, 1982 and March 1, 1984.

3.2 Geotechnical Investigations

To begin construction in the Summer of 1982, it was necessary to first complete significant geotechnical investigations in order to support the design of the surface facilities and the shaft and decline. These investigations were divided into three categories consisting of

alluvium studies along the White River which were associated with the installation of water wells for the project, grass roots core tests at shaft locations for shaft design and foundation studies, and soil and foundation studies throughout the mine surface construction area for building and facility design information. It was also necessary to conduct soil studies in the runoff retention dam area in order to develop design criteria for the dam.

The first geotechnical program was undertaken by Law Engineering and consisted of alluvial hydrologic studies along the south bank of the White River in the northwest quarter of Section 14, Township 10 South, Range 24 East. The purpose of this work was to determine the adequacy of the alluvium to supply Phase I water requirements from shallow wells along the White River. The work consisted of several test pits and drilling programs to investigate the location and type of gravels in the alluvium. After this information was evaluated, a test well was drilled and pump tests undertaken to determine the quantity and quality of water that could be expected from the production well. This information was then used to design two production wells in the alluvium with a capacity of 200 gallons per minute. These wells were subsequently drilled, developed and are currently in use.

The next phase of geotechnical work involved the shaft core test work and this was undertaken by D'Appolonia in late 1981 and early 1982. The D'Appolonia work was geared toward the shaft area. The contract called for two grass roots core tests; one located in the center of each originally proposed shaft and the other consisted of foundation testing in the immediate vicinity of each shaft.

Detailed geologic logging and associated studies were conducted on the core, as well as rock mechanic's testing at various intervals of both core tests. Hydrologic studies and pump tests were made in the Bird's Nest Aquifier as well as gas monitoring throughout the coring of the holes. A copy of the final D'Appolonia report has been submitted to the Oil Shale Office and the information has been used in the design of the shafts and the decline by J. S. Redpath and Parsons.

The third major geotechnical study was conducted by Woodward Clyde and involved soil and foundation testing in the vicinity of the mine surface facilities. Borings and additional test work were conducted in the soils and rocks in the area of the mine surface building, the decline, the proposed ore stockpile and conveyorways, and the water treatment and sewage treatment facility areas. Woodward Clyde also did soil studies on topsoil stockpile stabilization as well as studies of the soil and rock conditions at the runoff retention dam location. The results of these studies were used in the design of the footings and foundations of the mine support buildings and the runoff retention dam. Additional soil testing was also completed in the waste disposal area, along the various site roads, and the electrical substation area.

3.3 Engineering and Design

The engineering and design work that took place in 1982 falls in two categories: that required for actual construction; and that required for estimates; SFC Applications, and; feasibility studies. The final level of detail is different in each case. However, both cases involved the completion of significant engineering design as well as

specifications for all equipment and construction requirements. Also bidding, purchasing and contract functions were undertaken for those facilities to be constructed during the 1982-1984 time frame.

As previously discussed, three major contractors worked on the mine design and specification program for WRSOC in 1982 (i.e., Parsons, Redpath and Cliffs). The scope of work for each of these contractors was different, with Parsons being the prime contractor for the construction and study work.

Parsons' construction design responsibilities centered around the surface facilities including water treatment/sewage treatment facilities, the mine service building, site grading and roads development, water wells development, and other surface mine ancillary facilities. Additional design work completed by Parsons specifically for the definitive estimate included the stockpile conveyor reclaim system and the 10,000-ton storage bin. Parsons also worked on retorting, upgrading, and off-site and processed shale handling facilities as part of feasibility study and the SFC Application preparation.

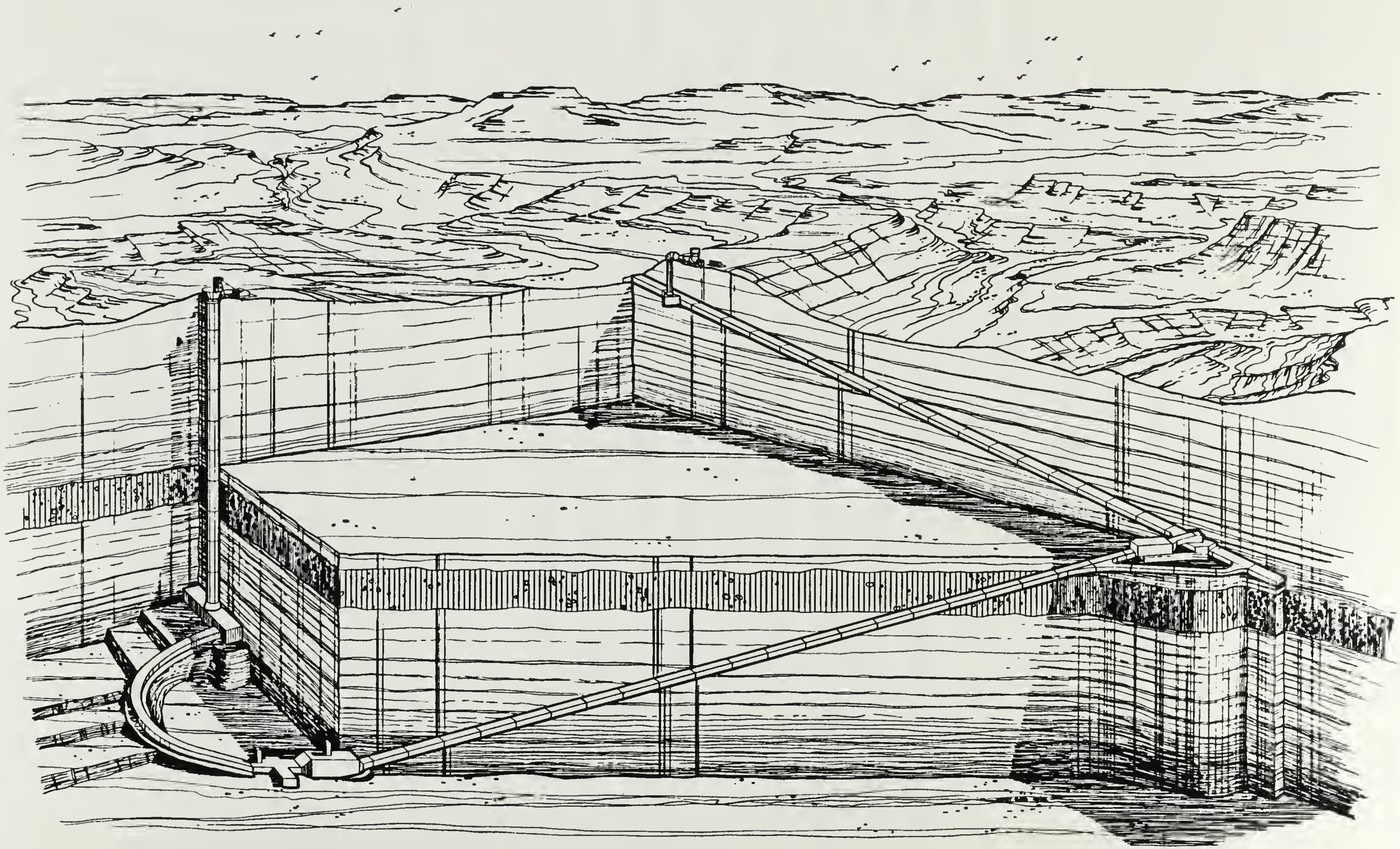
The designed flow of ore at the surface between the decline and the retort feed system will be by conveyor from the decline portal to the top of a 10,000-ton storage bin. The ore will flow through the bin and be withdrawn either to the screening plant which will screen out the fines and pass the coarse material on to the retort feed system or the rock will flow to the 400,000-ton stockpile for storage. When mine production cannot satisfy the retort requirements, then ore will be withdrawn from the bottom of the stockpile on a conveyor reclaim system

and conveyed back to the top of the 10,000-ton storage bin. With this system, WRSOC will have complete flexibility to put ore in or take it out of the stockpile and the 10,000-ton storage bin. It is intended that with this flexibility, the mine and the retort systems are decoupled and any operating problems in one area will not affect the operation in the other area.

The second engineering design contract in 1982 was awarded to J. S. Redpath in Tempe, Ariz. to design complete drawings for construction for the air intake and air exhaust shafts, the production decline, and the surface shaft with the headframe, hoist, and shaft internal equipment. Redpath completed their total design package by the end of 1982 including a cost estimate for each facility. It was during these initial studies and engineering work that WRSOC decided to make the change from a production shaft to a production decline. The studies indicated that a production decline represents less capital cost and significantly less operating cost over the life of the mining operation when compared to a shaft hoisting operation. The details of this change from the DDP were submitted to the Oil Shale Office in September of 1982.

Figure 3-4 presents an artists conception of the Phase I Production decline and air intake shaft. WRSOC decided to begin excavation of only the production decline and the air intake shaft in the latter part of 1982; while the surface shaft and the exhaust shaft, although fully designed, will not be constructed until work begins on the surface process plant. WRSOC has design specifications and construction drawings for both the surface shaft and the exhaust shaft. Therefore,

Figure 3-4



WHITE RIVER SHALE PROJECT
PHASE 1 PRODUCTION DECLINE & AIR INTAKE SHAFT

when a decision is made to proceed with these facilities, a bid package can be compiled rapidly and the work started in a relatively short period of time.

The third contract for mine design work was awarded in 1981 to Cleveland Cliffs Engineering in Rifle, Colorado. Cliffs was given the assignment to design the underground mine plant and layout, including the required equipment, utilities and ventilation to satisfy a production rate of 30,000 TPD. The basic parameters given to Cliffs, including a 55-foot mining height with the roof at the base of the "A" groove, a 30,000 TPD operating rate, and a 100% gassy mine classification. Cliffs was asked to develop operating and capital costs for a mine at the above capacity. It was further decided that both primary and secondary crushing would be handled underground. However, the design of these two facilities was the responsibility of Parsons.

Cliffs designed a large room and pillar mine beginning south of the shaft/decline location and trending to the east from Ua into Ub. The proposed mining method consisted of a conventional drill and blast, room and pillar operation with an upper bench of 25 feet and a lower bench of 30 feet and roof bolting on four and five-foot centers.

A truck haul, front-end loader system was selected for ore haulage from the face with subsequent hauling to the primary crusher in the shaft station. A great deal of work was done on various panel layouts to develop an operating plan that was compatible with ventilation requirements. Ore hauled by truck from the face to the crusher will pass through a 48-inch grizzly and be crushed in a single roll primary

crusher to ten inch and will then be conveyed to a secondary double roll crushing system for crushing down to a top size of 2 inch. The ore will then be fed to the decline conveyor system and be conveyed to the surface.

Later studies on underground haulage systems indicated that there may be a cost advantage factor in favor of an LHD/feeder breaker system over truck haulage. WRSOC's current mine plan philosophy includes maximum flexibility so that unforeseen conditions, be they in the area of water, gas, rock machanics stability, or geologic conditions, can be incorporated into the mine plan without undue safety or cost implications.

3.4 Mine Construction Activities

3.4.1 Shaft Construction

The WRSP Phase I shaft requirements, as stated previously, include a service shaft, an air intake shaft, and an exhaust shaft. All three shafts are designed to be 30 feet in diameter, concrete lined, and equipped with emergency escape hoists. In the case of the air intake and exhaust shafts, there will be no constructions within the shafts other than the escape hoists. The main exhaust fans, with a capacity of at least 3,500,000 CFM, will be installed on the exhaust shaft in order to maintain negative pressure in the mine. The service shaft, located within 250 feet of the air intake shaft, will be equipped with a

main service cage and a counterweight driven by a tower mounted friction hoist.

WRSOC intends to service the mine completely through the service shaft with no travel in the decline conveyorway other than that required for inspection and maintenance.

The service shaft will be downcast with approximately 500,000 CFM which will be routed through the shaft station and maintenance shop area and then exhausted up the decline system. This air will also ventilate the primary and secondary crusher facilities. The 3,000,000 CFM entering the mine through the intake ventilation shaft will be taken directly out to the working panel and development areas for ventilating the main portion of the mine.

During the summer and fall of 1982, WRSOC, through Parsons, put together a bid package with all engineering and design specifications for the decline and air intake shaft. WRSOC subsequently went our for bids to seven shaft contractors. The bids were received and evaluated, and a contract was let to Frontier-Kemper Constructors for the WRSP work.

Shaft mobilization and construction began in late 1982 and was completed, including the concrete lining, in December 1983. The Birds' Nest Aquifer, the only water zone in the section, was grouted off using cement and chemical grouts. The shaft currently makes less than one gallon per minute of water. The completed shaft is approximately 1054 feet deep. At the bottom

of the shaft, a 40-foot wide by 30-foot high by 215-foot long station has been excavated. This work was completed in February of 1984. Ongoing work through the shaft will involve development of an access ramp to connect with the bottom of the decline and also a decline connection on the mining level. Figure 3-5 presents a photograph of the shaft construction site.

3.4.2 Decline Development

The production decline concept being used by WRSOC will provide for a reliable, high capacity conveyor system to transport the mined ore from underground to the surface materials handling facilities. The decline has been designed with a dogleg bend so that the underground termination of the lower leg will be in the vicinity of the service and air intake shaft bottoms and the main shaft station, maintenance, and crushing facilities. This concept reduces the quantity of underground development required to reach panel mining areas and full production capacities.

The upper leg of the decline is inclined approximately 13° and is oriented to the northeast. The decline was excavated to a width of 28 feet and a height of 12 feet. The purpose of the 28 foot decline width is to provide for possible extension of the upper leg into the Ub Tract area and still allow enough decline width for a second conveyor to be installed for future expansion to Phase II of the WRSP, as per the DDP. The lower leg, with an excavated width of 18 feet and height of 12 feet, will provide ample room for a single, large, conveyor and travelway along

side it. The conveyor transfer point will be located in the dogleg which is stratigraphically above the Birds' Nest aquifer so that possible wet conditions will not interfere with this operating point. The completed decline will be approximately 5640 feet long. The top leg is 2042 feet in length while the "dog leg" is 360 feet, the bottom leg is 2488 feet and the access ramp is 750 feet in length.

Frontier-Kemper also mobilized in the late fall of 1982 for the decline construction and began actual excavation of the portal in November. Although they had bid the work on the basis of a drill blast operation, they proposed trying a roadheader type mining machine and, with WRSOC's approval, brought a Paurat machine on site to begin excavation in the decline.

The majority of both legs of the decline was excavated with the Paurat. However, in some of the harder sections of the Green River Formation, it was necessary to employ drilling and blasting techniques in the center portion of the excavation, while the Paurat was still used to trim to the design cross-section. As in the shaft, the Bird's Nest aquifer was grouted and is currently making 3 GPM.

The decline was rock bolted and shotcreted for stability. A concrete roadway and overhead lighting will be installed. By March 1984 the upper leg and dog leg portions were complete and the lower leg was down 1550 feet. All excavation work should be completed by August 1984. Total volume excavated from the

decline will be over 1,300,000 cubic feet. The total shaft volume was about 715,000 cubic feet. The original Frontier-Kemper contract schedule required completion of the shaft and decline by October 1984 and this will be met.

Figure 3-6 presents a photograph showing the decline portal construction area while Figure 3-7 presents a photograph of the Paurat mining machine used in the decline excavation. The shaft, decline, escape hoist, and vent fan, will all be completed during the summer and fall of 1984. The contractor will demobilize, clean-up, recontour, and revegetate as required as part of the construction contract. This total 1982 through 1984 construction schedule has been and is anticipated to be completed as planned and is consistant with the DDP and its schedule.

3.5 Mine Support Facilities Construction

3.5.1 Introduction

During the last half of 1982 several contracts were awarded to various construction firms for site preparation and grading, site road development, and construction of a mine services building, water treatment/sewage treatment facilities, a telephone/microwave system and other facilities required for the support of the mine development program. These facilities were completed and became operational in late 1982 and early 1983. Construction of these surface facilities proceeded per the

Figure 3-5
Ventilation Shaft Construction Area

Figure 3-6
Decline Portal and Associated Construction Area

requirements of the DDP and were completed on schedule and within budget.

3.5.2 Access Roads

WRSOC began construction on the Tract Access Road in April of 1982. The road was completed in September of 1982. The access road is approximately 3 miles in length and connects Utah Highway 45 near "Duck Rock" with the project site. The access road ends in the vicinity of the Phase I plant site, at a point near the center of tracts Ua and Ub.

Road construction included grading, drainage, surfacing, and rehabilitation of disturbed lands. All road construction was in accordance with the latest State of Utah specifications for road and bridge construction. Grading consisted of a substantial amount of earthwork for the subgrade which was obtained from roadway excavation and nearby borrow sites. Drainage facilities included cross drains and ditches for natural runoff, side drains, and headwalls and riprap pads. The roadway surface consists of 5 inches of bituminous surface course with 6 inches of untreated base course, over 14 inches of granular borrow. Limits of work were restricted to no more than 10 feet beyond the limits of grading. Disturbed areas were rehabilitated to the maximum extent possible, including erosion controls and revegetation as needed.

In addition to the construction of the tract access road, over 4 miles of various temporary roads were constructed in the vicinity of the mine site. These roads included a Temporary Mine Access Road which was developed along an existing unimproved road. The Temporary Mine Access Road was designed to permit safe access of personnel and large equipment to the mine shaft and decline areas as well as the mine service building areas. A Temporary Access Road to the Powder Magazine, a Temporary Access Road to the Solid Waste Disposal area, and a Temporary Road to the Water Well System were also developed during the March 1, 1982 through March 1, 1984 period.

All temporary roads were not paved. However, watering and/or dust suppressants were used to control dust and appropriate drainage and erosion control mechanisms were incorporated into the road designs.

In addition to the on-tract portion of the access road, Uintah County let contracts for the construction of a new road between Vernal and the Ua/Ub Tract boundary. The portion of new road between Vernal and Bonanza, including a new bridge over the Green River, was open for travel in September of 1982.

The last portion of the road from Bonanza to the Ua/Ub tracts was contracted through Uintah County with direct participation from WRSOC. This last section of road included a new bridge over the White River in the vicinity of the old Ignatio Stage Stop. This section of road and associated bridge, was opened in

December of 1982 with some minor "finish work" completed in the Spring of 1983.

Figure 3-8 presents a photograph depicting the new White River Bridge and the associated Tract Access Road.

3.5.3 General Earthwork

General earthwork activities included all site preparation required within the plant site boundaries. Included in the category was all site excavation work required for the development of the water treatment plant, the mine services building, the sewage treatment plant and associated holding pond, the substation and switchgear building, the solid waste disposal site and the power magazine storage area. In addition, site preparation also involved initial development work for all temporary "interior roads". Figure 3-9 presents a photograph showing an overall view of the WRSP site.

General earthwork within the plant site area began in July of 1982 and was generally completed by December 1982. However, cleanup and finishing work continued into early 1983.

Prior to any site preparation work in an area, available topsoil was stripped and stockpiled. Approximately 214,000 yards of topsoil were recovered during the March 1, 1982 through March 1, 1984 period. In addition, local erosion control methods were implemented as part of the site preparation program. Sections

Figure 3-7
Paurat Mining Machine

Figure 3-8
White River Bridge and Associated Tract Access Road

7.4 and 7.5 provide more detailed information on WRSOC's erosion control and topsoil management practices.

As of March 1, 1984, a total of 165 acres had been disturbed as part of site preparation activities associated with the mine development effort. Section 7.6 provides a more detailed discussion of disturbed and reclaimed areas.

3.5.4 Buildings

Construction of the Mine Services Building began in August of 1982. The building was completed and in use by March of 1983.

As shown on the plot plan (Figure 3-1), the mine services building is located in the southwest portion of the site at approximate coordinates of N588,500, E2,645,000. The rough graded building site is approximately 300 feet by 550 feet, or 165,000 square feet, and is accessed by a graded, gravel road. A compacted, gravel-base, employee parking area has also been developed adjacent to the building. The facility totals 27,000 square feet, including a 21,000 square foot warehouse area and a 6,000 square foot office.

The mine services building was constructed with a structural steel frame, a concrete foundation and metal roofing and siding. It is fully insulated and equipped with a heating, ventilation and air conditioning system.

The office wing of the building consists of one general office, conference room, rest rooms and lobby, bordered by fourteen smaller offices, a supply room and a reproduction services room. In addition to a 5,000 square foot storage area, the warehouse section does (or will in the future) include a tool room, men's and women's change rooms, a lunch/training room, a communications room, an electrical equipment room, and a Foreman's room. As further mine development and construction activities warrant additional support, the services building will be enlarged to house heavy equipment repair and other ancillary facilities.

Figure 3-10 presents a photograph of the completed Mine Services Building.

In addition to the Mine Services Building, numerous temporary structures were erected on site during the March 1, 1982 through March 1, 1984 period. Approximately 21 mobile trailers were also brought on site in support of the construction effort.

3.5.5 Water Supply and Treatment

During the March 1, 1982 through March 1, 1984 period, WRSOC developed a water supply system sufficient for our initial construction needs. The system consists of two alluvial wells, a water truck loading facility and a raw water treatment system.

Figure 3-9
Overall WRSP Site View

Figure 3-10
Mine Services Building

Two alluvial water wells were developed in the northeast corner of Tract Ub, Section 14, Township 10S, Range 24E. The wells are 10 inches in diameter and 30 to 40 feet deep, depending upon the thickness of the sandy travel unit at the selected locations. Both wells were grouted between the casing and the drill hole to a depth of 18 feet as per State of Utah Regulations for Water Well Drillers (Utah Division of Water Rights). Based on alluvial water well explorations completed in April 1982, the two wells were spaced approximately 150 feet apart to minimize drawdown interference, and each can pump at a rate of 200 gpm.

Water from the wells is piped to a nearby truck loading facility and hauled to the mine raw water tank for subsequent treatment, storage in the potable water tank, and distribution. Figure 3-11 presents a photograph of the WRSP alluvial well field along the banks of the White River.

Two tanks were constructed at the mine site for the water system: the raw water tank and the potable water tank. The tanks are located within the water treatment facilities area. Both tanks have an inner diameter of 36 feet and were constructed of carbon steel. The raw water tank is 25 feet high with a net capacity of 150,000 gallons and the potable water tank is 28 feet high with a net capacity of 180,000 gallons. The capacity of the potable water tank includes 80,000 gallons for potable use and 100,000 gallons for fire water storage.

Tank design and erection was in accordance with American Petroleum Institute Standard 650 (API 650).

The water treatment plant is capable of producing a total of 129,600 gallons of potable water per day. The system consists of the following processes: coagulant and coagulant aid feed; flash mixing; flocculation; clarification; filtration; and chlorination. The water treatment building also includes a fire pump room. The fire water pump will be used to increase water flow during fire fighting needs.

The water treatment plant has been designed to operate as follows. Raw water mixes with alum and polymer in a flash mix tank, and then flows into a flocculation chamber where a mechanical flocculator produces highly settleable floc. Floc settles out in a settling tank, and turbidity is removed from the supernatant in a granular media filter. The effluent is then chlorinated and pumped to the treated water storage tank. Solids collected in the granular media filter are removed by backwashing and the sludge formed in the bottom of the flocculation chamber is removed automatically.

Solids and sludge formed during the raw water treatment process are sent to a sludge pond and eventually disposed of in WRSOC's solid waste landfill.

The treated water distribution system feeds the mine services building, the service and ventilation shafts, and the future

mining storage warehouse and mining administration and change house building.

The water distribution system was designed, built, and tested according to American Water Works Association (AWWA) specifications. Water lines were laid at least 10 feet horizontally from sewer lines. If local conditions do not permit a 10-foot lateral separation, the water line was laid in a separate trench, on an undisturbed earth shelf on one side of the sewer line trench, or in a sewer line trench that has been backfilled and compacted to not less than 95% of maximum laboratory density. If the water and sewer lines are in the same trench, the water line was placed at least 18 inches above the sewer line.

The water distribution system was hydrotested at 235 psig for two hours. All pipe, joints, fittings, and valves were inspected during hydrotesting. After hydrotesting, the water distribution system was flushed and disinfected with a chlorine solution at 50 ppm for 24 hours. The system was then flushed with clean water until residual chlorine concentration was 0.2 ppm or less.

The fire protection water system is a looped line with 10 hydrants supplied by an electric driven fire pump with a diesel driven standby pump. Fire hydrants have been installed at appropriate locations throughout the mine site. The potable water/fire water system is maintained at 150 to 175 psig. A

pressure reducing valve was installed just inside the mine services building to reduce water pressure to 50 psig. A safety valve and drain, set at 55 psig, was installed immediately past the pressure reducing valve.

Figure 3-12 presents a photograph of the completed water treatment facility. The water treatment plant is housed in a prefabricated metal building containing approximately 2,400 square feet of space.

3.5.6 River Bank Stabilization

During February of 1983, WRSOC initiated an "emergency" bank stabilization program along the south bank of the White River in the northwest quarter of Section 14, Township 10 South, Range 24 East. The original shoreline of the White River had experienced a large amount of severe erosion which threatened to destroy the alluvial wells and the associated access road.

WRSOC placed approximately 500 feet of riprap along the river frontage. The riprap used consisted of rocks no less than 6 inches in size which were collected from areas where road development excavation had recently occurred. Figure 3-11, which depicts the WRSP alluvial well field, also provides an illustration of a portion of the river frontage where riprap was placed.

In order to ensure a successful placement of riprap, a river bank slope of 1.5:1 was established. The existing bank upstream

Figure 3-11
Alluvial Well Field on the Banks of the White River

Figure 3-12
Potable Water Treatment Plant

of the water well pad area, as well as a small downstream area, was laid back by removing material with a backhoe in order to achieve the desired slope. A two foot thick layer of riprap was then placed upon the sloped surface. Approximately 484 cubic yards of riprap was placed below the typical high water level.

During construction of the riprap revetments, site access occurred via the existing alluvial well access road. Earthen ramps were constructed from the existing pads (approximately five feet high) to the alluvial plain and river bank. An area approximately 100 feet wide along the bank was required for work activities. After the bank had been shaped to a 1.5:1 slope, riprap was placed on the slope using backhoe, dozing and end dumping techniques. Construction equipment worked from the existing river bank and no equipment was driven into the river. Excess material excavated from the river bank to create the 1.5 to 1 slope was contoured along the side of the well access road above the well area.

The emergency bank stabilization program discussed above proceeded under the provisions of the Nationwide Permits Program for Bank Stabilization Activities with the approval of the U.S. Army Corps of Engineers.

By October of 1983, large silt deposits associated with the high river flows during the summer months of 1983, built up along the shoreline in the vicinity of the riprap revetments.

Because of these silt deposits, the flow regime of the White River reversed its previous pattern of erosion and began to erode new areas of shoreline in the vicinity of the alluvial wells. Erosion in these areas was not anticipated when the original riprap revetments were installed, and in all likelihood, an erosion problem in these areas would not have occurred if the White River had not changed its flow pattern. As a result of this change, it was necessary to place an additional 500 feet of riprap along the river frontage to protect the alluvial well site.

Approximately 750 cubic yards of riprap were placed along the shoreline utilizing the same construction techniques discussed above.

This work required a 404 Permit from the U.S. Army Corps of Engineers, which WRSOC obtained on December 9, 1983.

3.5.7 Sewage Treatment

Construction of a 15,400 gallon per day sewage treatment system began in January of 1983. Advanced treatment utilizing an aerated equalization tank, primary clarifier, rotating biological contactor (RBC), final clarifier, sludge holding tank, chlorine contact tank and tertiary filter was selected as the system best meeting project needs and Utah State regulations. Treatment plant effluent discharges to an unlined pond for

evaporation and percolation. The description of these major treatment units is provided below.

i) Equalization Tank: An 8490 gallon underground, concrete equalization tank 10 feet x 16 feet x 14 feet in size, which will equalize diurnal flow fluctuations to provide a constant influent feed rate to downstream units, and to serve as a wet well for sewage pumping. The dimensions of this tank include a 7-foot freeboard, so that the sewage will enter the tank below the frost line. Air blowers (35 SCFM capacity) were installed in the equalization tank to keep solids in suspension and to keep sewage in an aerobic condition. Coarse bubble diffusers were used to provide proper mixing and aeration. Influent from the Mine Services Building is measured via a Kennison nozzle. Vertical pumps (20 gpm capacity) were installed to lift the sewage from the equalization tank to the primary clarifier. A flow control box regulates the sewage at 11 gpm as it enters the clarifier.

ii) Primary Clarifier: A 4188 gallon capacity primary clarifier with dimensions of 10 feet x 5 feet x 11 feet 2 inches concentrates solids over a surface area of 42 square feet. The clarifier tank is a rectangular section attached to two inverted hoppers with a flat bottom. An airlift skimmer removes floatable matter from the surface of the clarifier, while airlift sludge pumps (5 SCFM capacity) remove settled

sludge from the hopper. Both the floatable matter and the sludge are pumped at a rate of 100 gpd to the aerobic digester (sludge holding tank).

An effluent weir is included in the unit to prevent velocities from disturbing the quiescent zone. The loading rate at the weir is less than 10,000 gpd/ft.

iii) Rotating Biological Contactor (RBC): An RBC wastewater treatment unit provides secondary wastewater treatment. The RBC consists of a series of biological growth media segments which are slowly rotated while partially submerged in the wastewater promoting biological growth which attach to the growth media. Clow Corporation, the vendor for this unit, proposed a four section, Envirodisc RBC which includes a 4700 gallon wastewater tank and 22,000 square feet of 100% virgin high density linear polyethylene media. The polyethylene media contains an UV inhibitor to reduce ultraviolet light degradation.

A plastic enclosure covers the RBC. This enclosure has two doors and four inspection ports. The structure of the cover is capable of withstanding 40 psf basic snow lead and 30 psi wind velocity pressure.

iv) Final Clarifier: The clarifier is 10 feet x 5 feet x 11 feet 2 inches in size, and has a surface area of 42 square feet.

The final clarifier captures solids following the secondary treatment phase. The shape, skimmers, pumps and weir are the same as for the primary clarifier. However, the 80 gpd of sludge generated is pumped back to the equalization tank to provide initial biologic activity in the tank.

v) <u>Sludge Holding Tank</u>: An aerobic digester (10 feet x 8 feet 6 inches x 11 feet 2 inches) with a 7333 gallon capacity was selected as the sludge holding tank. The tank is rectangular in shape with fillets at the base to prevent the tank accumulation of solids and to enhance mixing. Diffusers introduce air along the entire length of the tank.

vi) <u>Chlorination</u>: A rectangular chlorine contact tank (9 feet 8 inches x 4 feet x 2 feet 6 inches) can detain 598 gallons of secondary clarified wastewater at any one time to disinfect the wastewater. Sizing of this tank was based on a minimum detention time of 45 minutes for 24 hours. Sodium hypochlorite is the chlorine compound used for disinfection. This solution is fed into the contact tank by an injection pump.

vii) <u>Tertiary Filter</u>: A tertiary sand filter provides final wastewater treatment. Water with total BOD_5 and suspended solids concentrations of 25 mg/l each is reduced to concentrations of less than 10 mg/l BOD_5 and less than 5 mg/l suspended solids. Sand is scoured clean mechanically by

compressed air action. Backwash water (5% of the filter feed) is piped back to the equalization tank for retreatment.

viii) Effluent Pond: Tertiary treated effluent flows by gravity from the treatment area to a holding pond via a 4-inch cast iron service weight pipe.

The holding pond has a 2-month storage capacity (minimum 924,000 gallons) and is capable of both evaporation and percolation into the underlying ground.

The pond covers approximately 1 acre, is 15 feet deep, and is surrounded by a road-topped dike approximately 20 feet above the pond's bottom. The dike was constructed of compacted fill material with 2:1 slopes. A high density polyethylene membrane 40 mm thick was put on the inside face of the dike to prevent downstream percolation through the dike. A 6 foot high chainlink fence was constructed around the perimeter of the pond, for safety of project personnel and wildlife.

In addition, an 18-inch corrugated metal pipe overflow spillway is located at the northeastern side of the pond. A 12-inch thick rubble lining was placed at the foot of the spillway to dissipate the energy of overflow waters.

A pipeline was installed to deliver influent sewage to the treatment from the Mine Services Building. The sewage pipeline

was composed of 6-inch PVC Gravity Sewer Pipe ASTM D-3034, SDR 35, Locked-In Rubber Ring Joint type with integral wall bell and spigot joints (Johns Manville "Ring-Tite" PVC Sewer Pipe TRX-11). It was laid within a trench at a minimum depth of 6 feet in order to be beneath the frost line. In addition the trench was placed at least 10 feet away from the potable water pipeline to avoid possible contamination.

The overall sewage collection system was designed, built and tested according to American Society for Testing and Materials (ASTM) and American Water Works Association (AWWA) specifications.

Construction of the Sewage Treatment Plant was completed in May of 1983. However, a number of factors had changed since the basis for design was developed. Frontier-Kemper, WRSOC's mine development subcontractor, elected to utilize a Paraut road header machine to excavate the mine production decline. The decision to utilize this specialized equipment rather than the conventional drill and blast methods for mine development resulted in an overall manpower reduction of approximately one-third. This occurance coupled with the fact that Frontier-Kemper also elected to utilize "chemical toilets" and temporary shower facilities for their employees resulted in a significant reduction in the amounts of domestic wastewaters being produced.

Following discussions of the above circumstances with the wastewater treatment facility design and fabrication contractor, Clow Corporation, it was determined that the facility could not reliably function at such low influent flow rate. It was therefore decided to "mothball" the facility for future use. The plant was "mothballed" in accordance with procedures developed by Clow and Parsons.

During the period when the facility was mothballed, sewage generated by Frontier-Kemper's construction personnel continued to be serviced by Rocket Sanitation (Duchesne, Utah) and dumped at the Vernal City Sewage Plant in accordance with their agreement with Vernal.

Sewage generated at the Mine Services Building was sent to the 8,490 gallon underground concrete equalization tank at the wastewater treatment facility where it was held for disposal on a periodic (typically once a week) basis. Arrangements were made to utilize Rocket Sanitation to provide pumping and disposal services.

Figure 3-13 presents a photograph of the completed sewage treatment facility.

3.5.8 Communications

The primary means of communication on-site is via telephone. The telephone system is dependent upon a microwave system with

an intermediate station on Blue Mountain just east of Jensen, Utah. At the site, the microwave system is hardwired to a ROLM PBX system. At the Vernal WRSOC office, the microwave is hard-wired to Mountain Bell's Vernal exchange.

As part of the communication system, a 120 foot microwave tower and an associated equipment building were installed on-site. The tower and the equipment building are located approximately 200 feet northwest of the mine services building. The equipment building is a prefabricated structure of prepainted, galvanized, insulated steel with dimensions of 8 feet x 8 feet x 10 feet high. It was erected on a 4 inch thick concrete slab.

The first phase of a proposed four phase communications system was made operational in December of 1982. WRSOC received a Microwave Radio Station License for the system from the FCC on October 29, 1982. The system has a total capacity of 96 lines.

Figure 3-9, which presents a photograph of the overall WRSP site, also shows the installed microwave tower.

3.5.9 Electric Power

WRSOC completed the installation of a 13.2 KV electrical power distribution system in the Fall of 1982. The Moon Lake Electric Association (MLEA) upgraded an existing single phase 13.2 KV line, which served air station A6, to a three-phase 13.2 KV line. MLEA also constructed a new three-phase 13.2 KV line from

the air sampling station to the WRSP interface pole at approximate coordinates N597,025 E2,653,734.

WRSOC constructed the electric line from the interface pole south and west to the mine services building and the surface mine substation. A second electric line was constructed by WRSOC and interfaces with this pole line at approximate coordinates N593,380 E2,648,720 in the northwest quarters of Section 23 and subsequently runs north to the raw water pump station in the vicinity of the alluvial wells. The total distance involved with both of these pole lines was approximately 4 miles.

As required by the lease environmental stipulations, pole design conformed with the recommendations made in the United States Department of Agriculture (USDA), Rural Electrification Administration (REA) Bulletin No. 61-10, dated March 9, 1979. Conformance with this bulletin reduced the risk of electrocution to raptors utilizing these poles as perches.

Power conveyed by these lines is used at the mine services building for lighting, heating and other general uses. In addition, the services building connection supplies operating power for both the potable water and sewage treatment facilities. The second line running up to the raw water pump station services two 15 HP submersible water pumps, a transformer and a water truck loading facility. The 13.2 KV power line is capable of delivering approximately 1,000 KV of power to the site.

Since a permanent power system had not been developed when WRSOC's contractor began sinking the ventilation shaft and driving the production decline, WRSOC, by contract, paid a power penalty to enable the contractor to generate his own power. The contractor elected to lease two 1,000 KW generators for the main power and supplement this source with two company owned 400 KW generators.

WRSOC also committed 800 KW from the temporary (13.2 KV) power line to the contractor, enabling the contractor to put continuous loads on line power, such as ventilation fans, air compressors and surface facilities. Erratic or impact loads such as the shaft hoist motor and the Paurat continuous miner were connected to diesel generators.

A substation and Switchgear Building was completed in 1983. The excavation, gravelling and fencing of the switchgear yard was completed in January. The building and switchgear installation was completed in August of 1983. The substation yard building and switchgear are constructed to be part of the permanent electrical distribution system and is yet to be put in service.

As of March 1, 1983, work was proceeding on the development of a permanent high voltage (138 KV) power source. In June of 1983, applications for Right-of-Ways were submitted to the BLM by both WRSOC and Utah Power and Light (UP&L).

The UP&L application describes a 138 KV electric power transmission line beginning south of the Bonanza Power Plant in Section 2, Township 9 South, Range 23 East, the terminating in Asphalt Wash (Section 24, Township 10 South, Range 23 East) west of the WRSP. The WRSOC application describes a transmission line beginning in Asphalt Wash, at the termination of the UP&L line, and extending to the east into the WRSP plant site.

The WRSOC system will involve construction and operation of a 138 KV power transmission line which will be approximately 22,700 feet in length. About 17,300 feet of the line will be within the boundary of Tract Ua and about 5,400 feet will lie to the west of Tract Ua. The WRSOC line will begin in the Southeast quarter of Section 24, Township 10 South, Range 23 East, in Asphalt Wash and parallel a section of the new UP&L line into the Northwest quarter of Section 19, Township 10 South, Range 24 East. From that point the WRSOC line will traverse to the east, southeast into a electrical substation at the WRSP plant site in Section 22, Township 20 South, Range 24 East.

See chapter 10 for additional information concerning status of the permanent power agreement with UP&L.

3.5.10 Runoff Containment

Construction of a 211 acre-foot plant site wash runoff retention dam and pond began in January of 1983 and was completed in October of 1983.

The retention pond is located in Section 15 and 22, Township 10 South, Range 24 East, with coordinates N593,900 E2,644,890 in the northeastern corner of Tract Ua. It is located on the northern edge of Tract Ua and is approximately 5120 and 4940 feet north of the processing area and surface mining facilities area, respectively, measured from the midpoint of the dam to the midpoint of each area.

A new road was constructed for access to the dam site. The new road branches off of an existing road southeast of the retention pond site. The road follows the southwestern side of the pond and provides access to the southwestern side of the dam. It then proceeds across the canyon to the northeastern side of the dam. The road provides access to the dam, spillway, a small seepage holding pond, a surface water monitoring station, and groundwater monitoring wells.

The dam design is based on the capacity of the reservoir to contain runoff from a storm with a 100-year return interval, determined from historical rainfall data. Dam specifications conform to Utah dam safety regulations, Utah Code 73-5-5. The major environmental concern is to prevent potentially contaminated waters from entering the White River. The 100 year storm was chosen as the design basis to assure retention of all storm water runoff in order to reduce to a minimum the possibility of discharge to the White River.

The retention dam has a length of approximately 620 feet, a height of 47.5 feet above bedrock, and a width of 20 feet at the top of the dam. The bottom of the dam varies in width along its length, with a maximum width of 320 feet. The holding pond, when filled to the 5180 foot contour level, will have 211 acre-feet of capacity, a total water surface area of 11 acres, and a maximum depth of 59 feet. Maxmimum depth of the dam is greater than dam height because alluvium was removed from the pond to a greater depth than the bottom of the dam.

The dam design includes an impermeable clay core with silty sand on either side and a three-foot layer of riprap covering the surface for slope protection. To control seepage from the retention pond, the dam and abutments were gouted to depths of 20 to 60 feet below bedrock level. The abutments were grouted to 90 feet below the dam crest elevation.

The holding pond was excavated to bedrock and topsoil was recovered and used for reclamation of areas disturbed by retention pond and other construction activities. Excavated alluvium below the topsoil was used as backfill in dam construction. Excess alluvium was stockpiled for use in on-tract construction activities.

The dam has an open-channel, chute-type spillway. The dam is designed to handle runoff from the 100-year storm (3 inches in 24 hours) with approximately 6.5 feet of freeboard. The spillway opening is located at the bottom of the freeboard at maximum

water level. If the water level rises above the bottom of the freeboard, water will be discharged out the spillway.

Seven groundwater monitoring wells were drilled, arranged in a crescent along the downslope perimeter of the retention dam and grout curtain. Some of the wells were drilled to the bottom of the grout curtain, while others were drilled below the bottom of the grout curtain. The shallower wells will monitor groundwater movement through the grout curtain, while the deeper wells will monitor groundwater movement passing below the marlstone unit.

Each monitoring well is designed with a shallow water tight sump at the casing bottom. Any significant amount of groundwater entering a well through any portion of the screened interval will collect in the well sump. Monitoring consists of field measurements of water quality and the water level of groundwater contained in each well sump. Occasionally, samples of this water will be retrieved for laboratory analysis. See Section 7.3 for additional information on the monitoring wells.

Figure 3-14 presents a photograph of the completed dam looking at the downstream portion of the dam.

In addition to the Plant Site Wash Runoff Retention Dam and Pond, WRSOC constructed a small mine area runoff retention pond as part of our Phase I construction activities. This small runoff retention pond is intended to serve as a settling pond for storm water runoff.

Figure 3-13
Sewage Treatment Plant

Figure 3-14
Runoff Retention Dam - Downstream View

The pond is approximately 280 feet in diameter and approximately 4 feet deep. The pond is located in a natural drainage channel with coordinates N588,175 E2,645,500. The pond was designed for a capacity of 11 acre-feet and can accomodate a 100-year storm event. An 18 inch ductile iron pipe diverts water from the pond under a nearby road to the natural watercourse. The water is eventally collected by the 211-acre foot Plant Site Wash runoff retention pond (discussed above) located north of the mine area retention pond.

Section 7.4 discusses various temporary runoff control measures employed during the construction periods between March 1, 1982 and March 1, 1984.

3.5.11 Explosive Magazine Area

An Explosives Magazine Area was located approximately 1,800 feet southeast of the Mine Services Building, behind a high butte. A temporary road was built for access to this area.

The area has been utilized by subcontractors for storage of explosives and detonators used for underground excavation. Five portable magazines were in use. The magazines were of metal construction and were 7 feet x 8 feet x 7 feet in size. One was used for detonators; the other four for explosives.

Magazine construction was in conformance with ATF regulations. The magazines were vented, bonded, grounded, and the area posted

with danger signs. Regular inspections and inventories were made.

3.5.12 Fuel and Lube Handling

Permanent fuel and lube handling facilities were not constructed during the March 1, 1982 through March 1, 1984 period because WRSOC had no need for them during this phase of the project. Temporary facilities necessary to support the activities of the subcontractors were installed following the guidelines given in the D.D.P.:

- Storage areas were located so that accidental spillage would not drain into water courses or ground waters.

- Drip pans, catch basins, etc. were used to control spills or leaks at oil storages.

- Storage in excess of 500 gallons was provided with containment structures.

- Waste oils, chemicals, and/or toxic materials were stored in barrels and periodically sent off-site for proper disposal.

- Fire extinguishers and warning signs were placed at each location.

The fuel and lube handling facilities were regularly inspected by MSHA and the Oil Shale Office and found to be acceptable.

3.5.13 Helipad

A 60 square foot asphalt helipad was constructed at coordinates N590,646.90 E2,645,899.65 during the late fall of 1982. The helipad was constructed for use in emergency situations. The helipad coordinates were distributed to the various helicopter services and hospitals in the Vernal area. The helipad is equipped with a windsock.

WRSOC notified the Federal Aviation Administration of our proposed helipad on November 15, 1982.

3.5.14 Temporary Construction Camp

In the Spring of 1982, WRSOC built a temporary construction camp to house those people who were non-area residents working on our tract access road. This temporary camp was designed to meet the standards contained in Uintah County's Construction Camp Regulations.

The camp was located along Utah Highway 45, just north of the point where WRSOC's tract access road begins and in the vicinity of Duck Rock. The camp was designed to temporarily hold a maximum of 49 recreational vehicles (RV). Forty-nine gravel covered

RV pads were constructed. Access roads to the pads were graded to elevation and also gravel covered.

A wastewater collection system was designed for 49 RV trailers, assuming that each had an average water tank capacity of 50 gallons. A 6-inch sewage collection pipe connected each RV site to a containment system consisting of two 2,000 gallon holding tanks (in series). Each of these underground tanks was equipped with a level indicating float device.

Scavenger service for the two tanks was provided by Rocket Sanitation from Duchesne, Utah. Rocket Sanitation emptied the tanks weekly or as needed. The drained sewage was then transported to the Vernal City wastewater treatment system.

Drinking water was not provided for the camp by WRSOC. It was the responsibility of each individual RV owner to provide for their drinking water needs. In order to avoid potential health problems associated with drinking non-potable water, there was no water holding tanks in the construction camp area.

Trash containers were located along the side of each pad. These containers were emptied regularly and their contents disposed in an acceptable off-tract landfill. Good housekeeping procedures were strictly enforced to insure that an acceptable camp appearance was always maintained.

The temporary construction camp was de-commissioned in mid-1983.

4.0 PROCESS DEVELOPMENT ACTIVITIES

4.1 Introduction

One of WRSOC's major assignments, in conjunction with the Owner companies' Process Committee representatives, was to define the scope of the WRSP. The scope was tailored to reflect WRSOC's desire to produce a synthetic crude oil from oil shale that can be supplied to existing refineries in place of imported crude feedstocks without requiring refinery modifications. It also incorporated the Owner companies' recommendation that the first synthetic crude oil be produced at a commercial rather than a semi-works scale, utilizing an overall project strategy that reduces risk to an acceptable level while still yielding an appropriate rate of return.

The resulting philosophy of phased expansion reiterated the developmental nature of the oil shale industry and the Owner companies' desire to control technological risk. It was decided that three phases would be used to expand the plant output to a projected capacity of nominally 100,000 barrels per day of syncrude production. It was planned that first phase, or Phase I, facility would provide the necessary experience and information to allow accurate assessment of the overall project:

1. Technical operability and reliabiity.
2. Capital and operating economics.
3. Environmental impacts and adverse impact mitigation.

The retorting and upgrading capacities in Phase I were selected to constitute a nearly optimal pairing between the number of retorting trains and a single upgrading plant. The design capacity of the Phase I facilities was fixed at 16,573 BPD of synthetic crude oil (upgraded shale oil).

Later project phases were seen to be accomplished through a modular expansion of, and integration with, the Phase I facility. The implications of this decision as they applied to the actual plant design are significant. First, the basic technical operability and reliability demonstrated in Phase I was expected to improve in subsequent phases. Unexpected and unpredictable operational problems due to equipment scale-up in Phase I would be corrected in future plants. Also, the economic projections developed during Phase I were seen to be directly transferable to later project phases through the use of duplicate trains, and so minimize the need to capacity factor units.

4.2 Retort Investigations

During 1982, the owners executed a license agreement with the Union Oil Company of California for the Unishale B Retorting Process. The license agreement allowed the WRSP owners and WRSOC to assign a total of six engineers to Union's operating staff at the Union Parachute Creek, Colorado, facility to participate during construction, startup and initial operation. The expertise developed by the WRSOC and owner engineers during this period will, in time, be directly transferable to the design, construction and operation of the Union retorts for Phase I of the WRSP.

As of March 1, 1984, three WRSOC and three owner engineers were assigned to the Union retort startup staff. The license agreement gives the WRSP owners full access to the final design drawings for the Parachute Creek retorting facility.

The Unishale B retort was selected as the retorting technology for Phase I of the WRSP on the grounds that the Unishale B technology would be the only retort demonstrated on Western U.S. shale in the timeframe consistent with the definitive engineering schedule of the WRSP.

4.3 Union Oil Company Pilot Plant Work

The Union Oil Company Unishale B pilot plant in Brea, California, was operated from August 15, 1983, to September 30, 1983, with shale extracted from Hell's Hole Canyon, Utah near Tracts Ua and Ub. This operation was conducted to provide data required to finalize the Unishale B process flow sheet for the WRSP feasibility study.

Data from previous pilot plant operations for WRSOC were deficient, primarily in gas yield information and in operation, with shale grades not close enough to the 26.5 gpt Fischer assay expected from the Ua/Ub site mining plan. Also, the crude shale oil deashing pilot plant, which did not exist when earlier retort tests were conducted, was operated at this time. Analytical test work was also increased over the level conducted in previous test runs to allow more complete determination of component material balances and to attempt tracking of low concentration components and their distribution to product and by-product streams.

By-product water streams from the retort and deasher units were inspected to investigate uncertainties in their treatment requirements. Product gas yield and composition data, as well as overall retort material balance data from the pilot plant operation, were incorporated to formulate the WRSOC Unishale B flow sheet for use in the feasibility study.

4.4 Circular Grate Retort Work

4.4.1 Introduction

Work conducted on circular grate retorts can be divided into two basic categories: physical test work and an engineering study.

Batch testing of Utah oil shale was conducted in 1982 by Dravo Corporation to obtain data for development of basic parameters for Utah shale to enable a feasibility grade circular grate design to be performed and to supply data for correlation with data from a future continuous-feed circular grate pilot plant test.

The following basic parameters were among those studies:

- o Required retort residence times
- o Retort bed pressure drop
- o Air/gas ratios
- o Shale bed height effects
- o Raw shale size consist effects
- o Gas rates

The relationships developed from the physical test work (i.e., batch testing) were used by WRSOC to perform feasibility-grade designs for the WRSP. The following items were among those studied or supplied by the study:

- o An evaluation of several operating modes applicable to circular grate retorts
- o Feasibility-grade designs, including:
  - retort and associated equipment specifications and sizing
  - process flow sheets
  - material balances
  - utility requirements
  - product and by-product quality and production rates
  - capital and operating costs

Results from this engineering study have been incorporated in an overall facility design and feasibility study.

4.4.2 Physical Test Work & Data Analysis

A total of 54 batch unit tests were conducted at Dravo's R&D facility between March 22 and October 1, 1982. These tests were conducted to obtain data for: (1) correlation with data from a future continuous-feed circular grate pilot plant test; and (2) development of the basic circular grate parameter relationships as a prerequisite for feasibility-grade design. Before these tests were conducted, data from both batch units and continuous-feed pilot plants had been inadequate from the standpoint of: (1) demonstration of process concepts and control; (2) range in

magnitude of variables studied; and (3) omission of collecting some pertinent data.

Groups of tests were performed to provide the following data and data relationships:

- o Required retort zonal residence times (as a function of gas circulation rates)
- o Predictability of retort bed pressure drop, a key in process control
- o Zone 1, the initial retorting zone, residence time effected
- o Air/gas ratio effect in Zone 2, the in-bed combustion zone
- o Shale bed height effects: 50" bed vs. 72" bed
- o Raw shale size consist effects
- o Effect on Zone 2 performance in the absence of a combustible gas
- o Effect of shale grade

4.4.3 Circular Grate Engineering Study

In early 1982, the WRSP Process Committee began a detailed assessment of the circular grate retorting process proposed by Dravo Engineers, Inc. In conjunction with this review, a pot test program was initiated with Dravo and completed in October 1982.

As the next step in the evaluation of this technology, it was proposed that an engineering study be conducted to investigate three circular grate retorting configurations. The first circular grate configuration (Case 1) is the process proposed by Dravo which included direct combustion induced carbon recovery from the processed shale. The second retorting configuration (Case 2) is an enhanced carbon recovery process independently developed by Phillips. The third circular grate retorting mode (Case 3) is a no in-bed combustion configuration.

The engineering study involved the WRSP owners, the WRSOC and Dravo Engineers, Inc. The process design for each configuration was done by Phillips' Corporate Engineering, with assistance from Sunedco, Sohio and WRSOC. Phillips developed a heat and material balance computer model to simulate each of the three circular grate retorting configurations.

Once the process design for each configuration was complete, the process package was forwarded to Dravo. In addition to providing the mechanical design, Dravo's final report included general plans and elevations, a detailed equipment list and a feasibility-grade (-25% to +25%) cost estimate for each retort configuration.

Phillips' Corporate Engineering then combined the process and mechanical designs with the cost estimates and developed a final report for the engineering study.

Two primary objectives were identified for the circular grate engineering study:

- Develop a feasibility-grade (-25% to + 25%) cost estimate for each configuration.
- Develop a comparative summary of the three retort configurations.

This study was completed over an approximate 11-month period in 1983 and overlapped several months with the evaluation of the physical test work data.

4.5 Upgrading Investigations

In January 1983, culminating a thorough evaluation of available alternate upgrading technologies including Chevron, Gulf, Union and Amoco, the decision was made to utilize Union Oil Company's upgrading process information in the Phase I analysis of the project. License negotiations were suspended in January 1983 subject to findings of the Phase I and Phase II Feasibility Study.

With respect to shale oil upgrading, there are basically two reasons for the choice of Union Oil Company technical information:

(1) From a maturity standpoint, Union Oil Company is judged by the sponsors at this time to have the broadest data base for a complete upgrading process, including deashing (included in the retort license package), demetallizing and hydrotreating.

(2) Subsequent to the December 1981 submittal, Union announced the development and inclusion into their licensing package of a catalytic dewaxing (selective hydrocracking) final step which produces, at relatively low incremental cost, a low nitrogen, low-pour point and very significantly lower viscosity product which is a fungible product in existing crude pipelines and refinery markets.

Nevertheless, the sponsors propose to continue to keep abreast of alternate process developments in the upgrading area.

With regard to the required level of shale oil upgrading severity, the subject has been examined in considerable depth. The conclusion reached is that the syncrude product should have a nitrogen content of less than or equal to 100 ppm. The controlling factor is product marketability. The criteria by which this conclusion was reached were:

(1) The nitrogen content of the naphtha fraction should be low enough to be accommodated in existing refineries at significant levels of shale oil in the refinery crude mix.

(2) Both the jet fuel and diesel fuel products should meet all product specifications and, in particular, the stability tests.

(3) All product fractions should be compatible in mixtures of shale oil syncrude and petroleum crude.

Sohio and Sun jointly carried out stability and compatibility blending studies using less than or equal to 100 ppm shale oil syncrude produced with and without the catalytic dewaxing step, in a mixture with Rocky Mountain Mixed Crude. The results completely demonstrated that the shale oil syncrude product will be, from a quality standpoint, a fully competitive premium crude in the crude marketplace.

In November 1983, Union carried out a series of upgrading pilot runs at different severity levels on crude shale oil derived from Ua/Ub shale to affirm that the yield structure used in the feasibility study was reasonably accurate.

5.0 WRSP FEASIBILITY STUDY

5.1 Introduction

In August 1983, The Ralph M. Parsons Company was authorized by the WRSOC, on behalf of the WRSP owners, to prepare a feasibility study to:

(1) Provide the WRSP owner companies sufficient technical definition and associated capital and operating costs to support proceeding with definitive engineering of the Phase I facilities.

(2) Develop Phase II capital and operating costs to confirm the economic viability of an expanded oil shale project as additional justification for expenditures on definitive engineering of the Phase I facilities.

(3) Provide capital and operating costs for the Unishale B and circular grate retorting technologies.

This feasibility study was conducted at R. M. Parsons under the direction of WRSOC. The study began in October of 1983 and was near completion by March 1, 1984. The study was scheduled to be complete by May of 1984.

Three cases were studied as part of the Feasibility Study:

(1) Phase I, the initial production facility.

(2) Phase II Base Case, the incremental facility expansion to a large, commercial production capacity using Phase I retorting technology.

(3) Phase II Alternate Case, the same incremental retorting expansion as the Phase II Base Case, with substitution of some retorting capacity with an alternate technology.

As part of the Phase II work, a number of studies were carried out to evaluate the potential for improving the project economics and optimizing the equipment configuration.

(1) Evaluation of eliminating the C_5+ recovery equipment and the crude shale oil stabilization unit.

(2) Design of an aboveground seal leg system.

(3) Optimization of the retort gas and liquid handling equipment.

(4) Conceptual design of the mechanical system necessary for the briquetting of the fines.

5.2 Phase I Study

5.2.1 Objectives

The Phase I case was studied to provide to the WRSP Owner com-

panies a cost estimate suitable for acquiring authorization for detailed engineering and definitive cost estimate work ("AFD" work). Also, the study was conducted to provide an estimate that could be used to track cost trends during the execution of AFD work.

For these reasons, the Phase I cost estimate was based on the individual equipment item cost estimates made for all equipment that was tag-numbered in the Phase I design. Certain key equipment items required vendor quotes based on the Union Oil Company purchase orders written for the Parachute Creek facility. Twenty-three purchase orders, covering over eighty tag-numbered equipment items, were used for this purpose. The remaining Phase I equipment was priced in-house by Parsons. The overall cost estimate was targeted for +/-25% accuracy.

5.2.2 Definition

The Phase I facility was defined by a 30,000-tpsd (dry) oil shale mine maximum capacity; (28,700 tpsd (dry) normal operating capacity), two 12,800-tpsd (dry) Unishale B retorts and a single shale oil upgrading plant processing 16,040 bpsd of raw shale oil.

5.2.3 Technical Deliverables

For each process unit, the following items were provided in the feasibility study, where applicable:

- Design basis
- Unit block flow diagram and overall material balance
- Physical and operating description
- Process flow diagram and material balance
- Utility requirements
- Catalyst and chemical requirements
- Equipment list for all tag-numbered equipment items
- Equipment data sheets for all tag-numbered equipment items
- Plot plan

The minimum requirements for each of these items was presented in detail in the scope-of-work document presented to R. M. Parsons by WRSOC.

5.2.4 Cost Estimate Deliverables

As laid out in the Phase I objectives, capital cost estimates were provided for all listed equipment items in each processing unit. The capital cost estimate for each equipment item was broken down to material and subcontract costs.

For each processing unit, total direct cost and total construction cost summaries were provided. The total construction cost was also summarized as equipment-type accounts (e.g., vessel, heat exchanger, pump, furnace and compressor).

5.3 Phase II Base Case Study

5.3.1 Objectives

The Phase II Base Case was studied to provide an indication of commercial capacity economics relative to the Phase I production capacity. Although retorting units were mostly replicates of Phase I units, certain retorting process units were combined into single trains. Also, shale fines are processed in Phase II.

Capital cost estimates were made from cost-capacity factoring Phase I unit costs where possible. The overall cost estimate was targeted for -15% to +40% accuracy.

5.3.2 Definition

The Phase II incremental addition to the Phase I facility was defined by:

Subjob	Phase II (Base Case Increment	Phase I and Phase II Total
Mining		
Maximum Capacity	60,000 tpsd (dry)	90,000 tpsd (dry)
Normal Operating Capacity	57,400 tpsd (dry)	86,100 tpsd (dry)
Retorting	4 Unishale B retorts @ 12,800 tspd (dry) each	6 Unishale B retorts @ 12,800 tspd (dry) each
	One circular grate retort processing agglomerated fines (9,905 tpsd)	One circular grate retort (9,905 tpsd)
Oil Upgrading	Two 18,396 bpsd upgrading trains (raw shale oil)	One 16,040 bpsd trains Two 18,396 bpsd trains

The detailed technical information for each process unit was incorporated into technical parts of the feasibility study.

5.3.3 Technical and Cost Deliverables

For each process unit, the following items were provided in the feasibility study, where applicable:

- o Design basis
- o Unit block flow diagram
- o Physical and operating description
- o Process flow diagram and material balance
- o Utility requirements
- o Catalyst and chemical requirements
- o Equipment list for all tag-numbered equipment items
- o Plot plan

Equipment data sheets were not provided for Phase II equipment items since the Phase II capital cost estimate was specified as a unit cost-capacity factored estimate. The minimum requirements for each of these deliverable items was defined by the scope-of-work document for the feasibility study.

Where Phase II units could not be estimated via unit cost-capacity factoring (e.g., where an alternate process such as circular grate retorting was used), units costs were developed on an individual equipment basis as in Phase I.

5.4 Phase II Alternate Case Study

5.4.1 Objectives

The Phase II Alternate Case was formed to provide a comparison of retorting technolgies: Unishale B versus circular grate technology.

5.4.2 Definition

Capital cost estimates were made from cost-capacity factoring Phase I unit costs where possible. The overall cost estimate was targeted for -15% to +40% accuracy.

The Phase II incremental addition to the Phase I facility was defined by:

Subjob	Phase II (Alternate Increment	Phase I and Phase II Total
Mining		
Maximum Capacity	60,000 tpsd (dry)	90,000 tpsd (dry)
Normal Operating Capacity	57,400 tpsd (dry)	86,100 tpsd (dry)
Retorting	2 Unishale B retorts @ 12,800 tspd (dry) each	4 Unishale B retorts @ 12,800 tspd (dry) each
	One circular grate retort processing agglomerated fines (9,905 tpsd, dry)	One circular grate retort processing agglomerated fines (9,905 tpsd, dry)
	One circular grate retort processing crushed shale (25,600 tpsd, dry)	One circular grate retort processing crushed shale (25,600 tpsd, dry)
Oil Upgrading	One 15,675 bpsd upgrading train for Unishale oil	One 16,040 bpsd train and one 15,675 bpsd train for Unishale oil
	One 19,515 bpsd upgrading train for circular grate retort oil	One 19,515 bpsd upgrading train for circular grate retort oil

5.4.3 Technical and Cost Deliverables

For each processing unit, the following items were provided in the feasibility study, where applicable:

- o Design basis
- o Unit block flow diagram and overall material balance
- o Description of unit and unit boundaries
- o Process flow diagram and material balance
- o Utility requirements

- Catalyst and chemical requirements
- Equipment list for all tag-numbered equipment items
- Plot plan

Equipment data sheets were not provided for Phase II equipment items since the Phase II capital cost estimate was specified as a unit cost-capacity factored estimate. The minimum requirements for each of these deliverable items was defined in the scope-of-work document for the feasibility study.

Where Phase II units could not be estimated via unit cost-capacity factoring (e.g., where an alternate process such as circular grate retorting was used), unit costs were developed on an individual equipment basis as in Phase I.

6.0 SYNTHETIC FUELS CORPORATION PROPOSALS

The Energy Security Act of 1980 established national synthetic fuel production goals for 1987 and 1992 and provided for the employment of financial assistance to encourage a technological diversity of processes, methods and techniques for each domestic resource that offers significant potential for use as a synthetic fuel feedstock. On June 30, 1980 the United States Synthetic Fuels Corporation (SFC) was created to implement the goals of the Energy Security Act.

On February 4, 1983, Phillips Petroleum Company, Sohio Shale Oil Company and Sun Shale Oil Company submitted an Information Response for the SFC's Third Solicitation which was issued by SFC on August 19, 1982.

On March 15, 1983, the Owners of the WRSP prepared and submitted a ten volume Qualification Proposal to SFC in response to the "Competitive Solicitation for Oil Shale Projects". On April 15, 1983, the WRSP owners were designated "Qualified Bidders" and were invited to submit a Technical Proposal and Competitive Bid to SFC by June 1, 1983.

On February 24, 1984, the Owners of the WRSP announced their intention to withdraw their request for financial assistance under the SFC's Third Solicitation.

7.0 ENVIRONMENTAL PROTECTION AND CONTROL

7.1 Air Pollution Control

Between March 1, 1982 and March 1, 1984 all on tract sources of air pollution emissions were associated with WRSP construction activities. Emission sources during this period can be classified into five categories:

1. Off-Highway Vehicle/Diesel Engine Emissions

   This category includes emissions associated with on-tract automobile travel, and light-duty diesel-powered vehicles, as well as emissions from temporary generators and other heavy-duty diesel-powered mine development equipment.

2. Fugitive Dust Emissions from Unpaved Roads

   This category includes fugitive dust emissions from pick-up trucks and automobiles traveling over on-tract, unpaved roads.

3. Mine Development Emissions

   This category includes emissions associated with shaft and decline construction.

4. <u>Fugitive Dust Emissions from Overall Construction Activities</u>

This category includes fugitive dust emissions associated with general construction activities, batch plant operations and wind erosion of storage piles.

5. <u>Emissions from Space/Water Heaters in Mine Services Building</u>

This category of emissions is associated with two 700,000 BTU/hr boilers are contained within the mine services building. These boilers fire #2 fuel oil and are used for space and water heating. During 1982, the boilers were not in operation.

The majority of unpaved, well-traveled site roads were covered with 5 inches of crushed rock and magnesuim chloride/water was applied as needed to control dust. It is assumed that these measures reduced dust emissions by 80%.

Settling and wet suppression were used to control fugitive dust emissions associated with mine construction activities. These control measures were also assumed to be 80% effective in reducing emissions. Watering was also used to control dust emissions associated with the overall construction activities on-tract.

Fugitive dust emissions from the batch plant operations were controlled by partially enclosing the batch plant and by washing the sand and gravel prior to use.

Fugitive dust emissions from topsoil storage pile erosion were controlled by seeding the piles with a mixture of native grasses.

Specific emission controls, other than those inherent in good maintenance practices, were not employed (or required) for mobile sources and/or services building boilers and blasting explosives.

All construction related emissions are covered under the umbrella of WRSOC's PSD Permit. WRSOC prepared an air quality impact analysis which addressed the emissions associated with the temporary power generators. The analysis indicated that air quality impacts would be minimal and that there would be no exceedance of the NAAQS or applicable PSD increments. This analysis was submitted to the Utah Bureau of Air Quality (UBAQ) on May 5, 1983.

Per the request of UBAQ, WRSOC prepared an emission inventory which attempted to estimate the emissions associated with the WRSP construction effort during calendar year 1983. A similar emission inventory will be prepared for 1984.

7.2 Solid Waste Handling

WRSOC has a Solid Waste Landfill plan which was approved by the Utah Bureau of Solid and Hazardous Waste on September 30, 1982. The plan was also approved by the OSPO on October 1, 1982.

Per the approved plan, WRSOC has developed a non-hazardous solid waste landfill on-site. The landfill is located within Southam Canyon near the southeastern corners of Tract Ua; T10S, R24E, Section 27. The landfill was designed for a 6 year operating life with initial operation beginning in the last quarter of 1982 and expected to continue through 1988. The period of operation of the landfill is intended to be concurrent with the construction of Phase I of the WRSP.

Only refuse and construction wastes were disposed within the landfill. (Hazardous wastes are presently not generated on tract.) Wastes were deposited in cells daily or as required. Cover material six inches thick was deposited over a cell at the end of any working day. The total capacity of the landfill is approximately 55,000 cubic yards.

The perimeter of the landfill is surrounded by a 5 foot high hog wire fence, with a gate at the northeast corner where the access road enters the site.

Fire protection for the solid waste landfill was handled by a mine construction fire brigade located at the Mine Services Buidling, approximately 0.8 miles from the landfill. The equipment used by the brigade included a 200-gallon tank truck with a 40 gpm pump, a 4,000-gallon reserve tank truck with a positive displacement pump, a variety of hoses, as well as axes and brush-cutting tools. Water for the tank trucks was obtained from a 180,000-gallon potable water storage tank located near the Mine Services Building. A fire reserve of 100,000-gallons was maintained in this tank.

As a good fire protection measure, the landfill was inspected during regular intervals. In addition, no open burning was allowed at the landfill.

The perimeter of the landfill site has been cleared of vegetation for approximately 15 feet to keep fires from spreading. This area and the access road to the site were regularly cleared of vegetation and/or litter to maintain a viable fire break and also prevent unsightly conditions at the landfill.

7.3 Water Pollution Control

The WRSP has been designed to be a zero discharge facility. All wastewaters will be reused within the process. In addition, WRSOC has constructed a runoff retention dam and pond to retain surface runoff from the two watersheds which drain the mining and process areas (approximately 850 acres).

The runoff retention pond and dam have been designed to accomodate runoff from the 100-year storm (i.e., 3 inches in 24 hours). The dam design includes an impermeable clay core and a three foot layer of riprap covering the surface for slope protection. To control seepage from the pond, the dam and abutments have been grouted to depths of 20 to 60 feet below bedrock level. WRSOC has received permits for the construction of the pond and dam from the following agencies:

Utah Bureau of Water Pollution Control (UBWPC), the Utah State Engineer, the Bureau of Land Management (BLM), the Oil Shale Office (OSO), and Uintah County.

The pond and dam were designed for zero discharge of waters. However, the dam does contain an open channel, chute type spillway located at the maximum water level. In the unlikely event of a discharge, the discharged waters would probably enter the White River which is approximately 1-1/2 miles north of the dam. WRSOC has obtained a zero discharge NPDES permit from EPA Region VIII to cover the remote possibility of a discharge from the dam.

In August and September of 1983, seven monitoring wells (six of which are multiple-tube wells) were installed in the Uinta Formation and alluvium below the retention dam. The main purpose of the network is to measure groundwater conditions and to detect potential leekage from the retention pond.

Water level measurements were made at several of these wells immediately following installation. The measurements indicate that all wells are correctly installed and functioning properly. A routine monitoring schedule for the retention dam wells has been established and results will be presented in 1984 water year reports. Well installation and data collection procedures were in conformance with requirements specified by the BLM in July 1983.

In addition to the groundwater monitoring system, there is a surface water monitoring station (Station 09306602) located below the retention dam. The current function of the station is to monitor seepage, spillway overflow and minor flows from local runoff below the dam.

As of March 1, 1984, no seepage or overflow have been detected by either of the above monitoring systems.

7.4 Erosion Control

Local temporary erosion control measures were implemented at the beginning of the WRSP construction activities and have continued, as appropriate, through March 1, 1984. Erosion control measures used included hay bale berms, hydromulching, surface roughening and contouring, diversion ditches and culverts. When possible, the amount of runoff over construction disturbed lands was minimized by preventing runnoff from adjacent undisturbed land from flowing onto the construction site. Peripheral ditches were used to intercept runoff and divert water away from the site.

Runoff which originated on construction sites was controlled by earthen berms and ditches which diverted water away from erodible disturbed slopes to natural drainage channels. In order to prevent erosion and excessive sediment transport in natural drainages, hay bale berms were installed in series down the drainage channels. The purpose of the berms was to decrease the velocity of the runoff streams and to trap

sediment by temporarily retaining the water.

Topsoil stockpiles have been shaped to minimize erosion. Diversion ditches or earthen berms were utilized to divert runoff from area surrounding the topsoil stockpiles. Berms were constructed around the downslope periphery of the mine area and access road stockpiles to prevent sediment loss due to runoff across the pile. The face of the retention dam stockpile has been covered with gravel and rock spalls to achieve a stable slope and to prevent sediment loss. During the construction of the stockpiles, wind erosion was controlled by watering the piles as necessary.

As soon as a significant portion of any long-term topsoil stockpile was developed to its final configuration, it was treated with a biodegradable soil stabilizer and seeded with a mixture of annual and perennial plants to prevent wind erosion and provide stabilization during the storage period.

Stabilization and maintenance procedures for short-term stockpiles consisted of pile configuration, watering, and/or treatment with a biodegradable soil stabilizing agent. All topsoil stockpiles were inspected on a regular basis by a Resident Construction Engineer to ensure that stabilization and erosion control measures were effective and sufficient. The frequency of these inspections increased with episodes of high winds and/or rainstorms.

If any long-term stockpiles develop rivulets six inches in depth over thirty (30) percent of its surface, the Topsoil Management Plan (see Section 7.5) called for the implementation of additional erosion control measures. These measures potentially consisted of using excelsior matting, jute netting, or a similar physical slope stabilizer anchored by wire staples. Such measures would provide physical protection against wind and water erosion as well as promoting water retention, thus maintaining a more suitable microhabitat for seed germination and growth. Any long-term stockpile areas requiring such measures would be reseeded prior to placement of matting or netting, either by broadcast seeding or hydromulching. If erosion of the extent described above occurred on short-term topsoil stockpiles, the Topsoil Management Plan called for the construction of earthen or straw bale berms around such piles to prevent further soil movement. This would prevent soil losses from these piles and subsequent impacts to surrounding vegetation.

In addition to the erosion control measures discussed above, disturbed areas were reclaimed when construction in a particular area had progressed to a point where no further disturbances were expected. See section 7.6 for further details on disturbed area reclamation.

7.5 Topsoil Management

WRSOC prepared a Topsoil Management Plan in August of 1982. The plan was subsequently revised in January of 1983. The purpose of the plan was to deliniate methods and procedures for recovering and stockpiling topsoil from areas disturbed by construction. The objective of this

plan was to ensure, as far as is practicable, that all recoverable top-soil is salvaged and stockpiled for later use in revegetation, prior to disturbing an area.

Two types of topsoil stockpiles have been developed: long-term (estimated storage duration exceeding 6 months) and short-term (estimated storage duration less than 6 months). As of March 1, 1984, three long-term stockpiles had been developed: a 34,990 yd^3 stockpile near the Mine Services Building; a 100,690 yd^3 stockpile off of the tract access road near the guard station; and, a 43,560 yd^3 stockpile in the vicinity of the runoff retention dam. In addition, one 5,000 yd^3 short-term pile has also been developed.

As of March 1, 1984, a total of 214,000 yd^3 of topsoil have been recovered. Approximately 179,000 yd^3 are in long-term stockpiles, 5,000 yd^3 are in a short-term pile and 30,000 yd^3 have been used for reclamation activities.

As discussed in section 7.4, appropriate methods have been implemented to prevent erosion of the topsoil stockpiles.

7.6 Disturbed and Reclaimed Areas

As of December 31, 1982, 127 acres of land had been disturbed by mine development related construction activities. At the end of 1983, an additional 34 acres had been disturbed, bringing the total disturbance

to 161 acres. During the first quarter of 1984, 4 additional acres were disturbed. Thus, a total of 165 acres have been disturbed as a result of mine development activities during the report period of March 1, 1982 through March 1, 1984. In addition, an approximately 3 mile long tract access road was developed in 1982. The road connects Utah Highway 45 near "Duck Rock" with the project site. The development of this road accounted for approximately 35 acres of additional disturbance.

Table 7-1 presents a summary of the WRSP revegetation effort to date. Two types of revegetation were employed: temporary and permanent. Temporary seed mix was used to revegetate areas where additional disturbances could occur. The temporary seed mix was used mainly to stabilize the disturbed area and thus prevent severe erosion problems. Areas where no additional work is planned have been revegetated with permanent seed mix and nursery-grown transplants at a rate of 1750 plants per acre. Table 7-2 shows the type of temporary seed mix used as well as the rate of application. Tables 7-3 and 7-4 provide similar information on the permanent seed mix and transplant species used for the WRSP revegetation efforts through March 1, 1984.

As of March 1, 1984, 23 acres of disturbed land have been reclaimed using temporary seed mixtures. In addition, 11.5 acres of disturbance associated with new development activities have been permanently reclaimed and 23 acres of disturbance associated with the tract access road have also been permanently reclaimed.

Table 7-1

SUMMARY OF WRSP REVEGETATION

Date	Temp/Perm	Areas	Contractor	Seed Rate lbs/acre PLS	Acreage
1982					
11/3-11/12	Permanent	Tract Access Road	S. B. Ellis	19.2	23.0
	Transplants				10.3
11/30-12/1	Temporary	Decline Portal Access Road & Mine Services Building pad slopes	S. B. Ellis	19.8	5.5
1983					
2/2-2/8	Temporary	Long Term Topsoil Stockpiles & Water Well pad slopes	S. B. Ellis	19.8	14.0
10/24-11/4	Temporary	Portions of Topsoil Stockpiles & Runoff Retention Dam area	NPI	21.5	3.5
10/24-11/4	Permanent	Portions along White River Access Road & Runoff Retention Dam	NPI	9.8	11.5
	Transplants				8.0

Table 7-2

TEMPORARY SEED MIX

FALL 1982 and
SPRING 1983 (Ellis)

Species	Purity %	Germ. %	PSxGerm.	lbs/acre net	lbs/acre PLS
Oryzopis hymenoides Indian Ricegrass	98.94	93	N/A	23.08 net	19.84
Elymus junceus Russian Wildrye	98.88	93	N/A		
Agrophyron smithii Western Wheatgrass	96.72	95	N/A	.8599 PLS/lb	
Chrysothamnus nauseous Rabbitbrush	70.00	90	N/A		
Sphaeralcea coccinea Globemallow	98.10	92	N/A		
Penstemon strictus Rocky Mtn. Penstemon	96.5	90	N/A		
Other crop seed					
Inert matter					
Weed seed	0.0				

FALL 1983 (NPI)

Species	Pure Seed %	Germ. %	PSxGerm.	lbs/acre net	lbs/acre PLS
Oryzopis hymenoides Indian Ricegrass	9.27	83	.0769	31 Total	2.38
Elymus junceus Russian Wildrye	25.01	94	.2351		7.29
Agropyron smithii Western Wheatgrass	36.24	83	.3008		9.32
Chrysothamnus nauseous Rabbitbrush	0.71	46	.0033		.10
Sphaeralcea coccinea Globemallow	7.05	63	.0444		1.38
Penstemon strictus Rocky Mtn. Penstemon	6.29	54	.0340		1.50
Other crop seed	1.23				
Inert matter	13.79				
Weed seed	.41				
	100.00				21.52

Table 7-3

PERMANENT SEED MIX

FALL 1983

Species	Pure Seed %		Germ. %		PS% x Germ.%		lbs mix/acre net		lbs PLS/acre	
	NPI	SBE*	NPI	SBE	NPI	SBE	NPI	SBE	NPI	SBE
Artemisia tridentata Big Sagrbrush	1.13	12.25	78	88	.0088	.1078			0.18	2.86
Atriplex cuneata Castle Valley Clover	7.30	13.35	49	80	.0036	.1068	20	26.5	0.72	2.83
Oryzopis hymenoides Indian Rice Grass	11.98	10.20	83	90	.0990	.0918			1.99	2.43
Agropyn smithii Western Wheat Grass	11.71	9.37	83	98	.0972	.0918			1.94	2.43
Artemisia nova Black Sagebrush	-	8.16	-	85	-	.0694			-	1.84
Atriplex contertifolia Shadscale	9.93	10.49	53.5	70	.0531	.0734			1.06	1.95
Atriplex canescens Four-wing Saltbrush	9.66	12.25	84	60	.0811	.0735			1.62	1.95
Chrysothamnus nauseous Rubber Rabbitbrush	0.74	12.24	46	90	.0034	.1107			0.07	2.92
Atriplex corrugata Mat Saltbush	9.64	-	55	-	.0550	-			1.06	-
Atriplex tridentata Trident Saltbush	7.18	-	39	-	.0280	-			0.56	-
Ceratoides lanata Winterfat	5.62	-	50	-	.0281	-			0.56	-
Other crop seed	0.09	-								
Inert Matter	24.90	11.29								
Weed seed	.12	.69								
	100.00	100.00							9.76	19.21
							PLS/lb net . . .		0.49	0.74

*NOTE: Rates provided by Steven B. Ellis for 1982 Permanent Seed Mix are shown for comparison.

Table 7-4

TRANSPLANT SPECIES USED

Fall 1982

Big Sagebrush	*Artemisia tridentata*	25 pct.
Rabbitbrush	*Chrysothamnus nauseous*	25 pct.
Black Sagebrush	*Artemisia nova*	20 pct.
Shadscale	*Atriplex confertifolia*	15 pct.
Four-wing Saltbush	*Atriplex canescens*	15 pct.

Fall 1983

Prostrate Kochia	*Kochia prostrata*	7.1 pct.
Gardner Saltbush	*Atriplex gardneri*	14.3 pct.
Four-wing Saltbush	*Atriplex canescens*	21.4 pct.
Big Sagebrush	*Artemisia tridentata*	21.4 pct.
Black Sagebrush	*Artemisia nova*	14.3 pct.
Rabbitbrush	*Chrysothamnus nauseous*	21.4 pct.

In the Fall of 1982, 5.5 acres of disturbed land along the decline portal access road and the Mine Services Building pad slopes were revegetated by Steven B. Ellis. The temporary seed mixture discussed in Table 7-2 was applied by hydromulching. In addition, disturbances associated with the tract access road were reclaimed using the permanent seed mix (applied by hydromulching) and the various transplants as discussed in Tables 7-3 and 7-4. A total of 23 acres associated with the access road disturbances were permanently reclaimed.

During 1983, additional spring seeding was performed between February 2 and February 8 by Steven B. Ellis. This work encompassed hydroseeding the long-term topsoil stockpiles and small areas which had been disturbed along the slopes of the waterwell pads and access road located on the White River alluvial bank.

Fall seeding was performed between October 24 and November 11, 1983 by NPI. This work encompassed hydroseeding 3.5 acres with temporary seed mix. In addition 11.5 acres were permanently reclaimed using drilled or finger harrow seeding with permanent seed mix and native tubling transplants. 8.0 acres of the 11.5 acres permanently reclaimed contained transplants.

Prior to reclaiming an area, topsoil was spread over the disturbed acres 8 to 10 inches deep.

As discussed previously, Table 7-1 indicates the rate of seed mix application used during the various revegetation efforts to date.

Note that in 1983, 9.8 lbs/acre PLS was used for seeding with permanent species mix.

7.7 Fish and Wildlife Management Plan

The objective of the Fish and Wildlife Management Plan is to establish procedures for the protection or restoration of the fish and wildlife habitat on the tracts. These are to be in accordance with Section 4 of the Oil Shale Lease Environmental Stipulations. The plan will identify steps to be taken to avoid or minimize damage to fish and wildlife habitat and water supplies, to restore habitat that is unavoidably destroyed or damaged, to provide alternative habitat, and to provide controlled public access. The plan will be implemented just prior to Phase I construction and will be discontinued after complete restoration when the project is decommissioned or abandoned. The details of the plan and the schedule for implementation will be developed in response to factors such as:

- The results of the 2-year baseline study and extended monitoring programs
- The intensity of habitat disturbance during each phase of the project
- Any relevant shifts in land-use patterns or priorities, such as hunting or grazing

The Environmental Stipulations of the lease for Ua and Ub require submission of a Fish and Wildlife Management Plan prior to initiating commercial production. Since fish and wildlife on the oil shale tracts are present due to the vegetation communities or habitats on the tracts, the plan provided is actually a habitat management plan. This plan identifies the habitat losses that will occur and mitigation efforts needed either to replace or improve alternative habitat for selected species.

Alternative habitat will be made available to mobile displaced species from the disturbed areas by means of habitat enhancement. By effectively raising the present productivity of the selected alternative habitat, it is anticipated that wildlife species displaced by disturbance and construction can be accommodated in selected remote areas, and will increase in population levels in those areas. Populations in these areas will probably be the source of individuals recolonizing the disturbed areas.

To enhance the alternative habitats, three steps are proposed in the DDP:

1) Modify present grazing practices, where possible, to increase plant biomass available for wildlife

2) Improve range conditions by interseeding selected areas of low plant density with native plant species suitable for wildlife (this is the subject of ongoing research)

3) Create small water holding ponds to increase the carrying capacity of the habitats

Work on step two began in late 1981 and continued during the March 1, 1982 through March 1, 1984 report period through the efforts of NPI.

Two areas, one with substantial annual plant cover and one with less than 5% annual plant cover, were seeded with a standard shrub/grass mix in October of 1981. Seed application was drill and broadcast. A few seedlings were observed in the drill seeded area in June 1982. By fall, 1982 none were observed in the entire seeded area and none were found in June or October of 1983.

Transplants of big sagebrush (*Artemisia tridentata*), fourwing saltbush, gardner saltbush (*A. gardneri*), and rubber rabbitbrush (*Chrysothamnus nauseosus*) were also planted in both areas (high and low annual plant cover). In June of 1982 plants of all four species were found although survival percentages varied; however, only sagebrush survived until October of 1983. The greatest cause of mortality during this period was primarily due to rodents and rabbits. The results of heavy grazing was evident on the majority of the non-living species as well as those still showing signs of growth. Thus, in October of 1983 this study was reinitiated utilizing techniques to protect both seedling and transplants from animal damage until they become established. Eighty plants of four species (sagebrush, fourwing saltbush, shadscale, and rabbitbrush) were planted. One half of all the plants were protected with Vexar tubing while the other half had no protection. By November

of 1983 only sagebrush survived of the unprotected plants, while survival was over 99% for all of the protected plants.

For additional information on WRSOC's efforts concerning interseeding and interplanting for wildlife habitat enhancement see Section 7.1 of "1982 Progress Report, Environmental Program, White River Shale Project" and Section 7.1 of "1983 Progress Report, Environmental Program, White River Shale Project".

7.8 Historic, Scientific, and Aesthetic Resource Protection

On February 1, 1983, WRSOC received a final archaeological clearance for the WRSP from the Utah Division of State History. A total of eight archaeological sites exist within the tract boundaries of Ua and Ub. It has been determined that the WRSP's proposed development will not impact four of these sites. Three of the remaining sites are located within the vicinity of WRSOC's water well pump station and truck loading facilities. In an August 4, 1982 letter to WRSOC, BLM stated that these sites would not be adversely impacted by construction of the pump station and truck loading facilities.

The last remaining site, 42UN407, is located in the vicinity of the runoff retention dam and pond. As part of the archaeological clearance process, WRSOC hired Nickens and Associates to develop mitigation measures for site 42UN407. On March 24, 1982, Mr. Allan Reed of Nickens and Associates and Mr. Blaine Phillips of the BLM inspected site 42UN407 and agreed upon mitigation measures which resulted in a slight relocation of the proposed original location for the runoff

retention pond and dam. This relocation prevented the possibility of the site being inundated by waters contained in the runoff retention pond. In addition, to avoid direct impacts upon 42UN407 by road improvements associated with the temporary mine construction road, all construction activities were confined to the location of an existing road and southward on the side of this road opposite from the rock-shelter containing 42UN407. Temporary field markers were established in the area where a new routing of the proposed temporary mine construction road was necessary to avoid the site. The temporary mine construction road was completed and site 42UN407 was not impacted.

7.9 Reclamation Bonding

On March 26, 1982 a $1,000,000 Reclamation Bond was filed with the Department of Interior as required by Section 9b of the Oil Shale Lease. The bond requirements were calculated by the Department of Interior's Oil Shale Office in Grand Junction, Colorado.

On August 20, 1982, WRSOC filed an additional $1,500,000 reclamation bond with the Utah Division of Oil, Gas and Mining (DOGM). This bond was required as part of WRSOC's Phase I Mining Permit and covered 110 acres of disturbance.

On February 14, 1983, a Memorandum of Understanding (MOU) between DOGM and BLM was signed. This MOU eliminated the need for "double bonding" with both the Federal government and State government on federal lands in Utah.

On February 18, 1983, WRSOC received approval from DOGM to expand the limits of work area from 110 to 470 acres. This approval required a total reclamation bond of $4,400,000. Therefore, on March 3, 1983, WRSOC increased its $1,000,000 reclamation bond with the BLM to $2,900,000; bringing the total reclamation bond(s) for the WRSP to $4,400,000.

7.10 Permit Status

As of March 1, 1984, 109 separate permits/approvals had been obtained for the WRSP. 97 of these permits/approvals were obtained between March 1, 1982 and March 1, 1984. Major permits obtained during this period include: PSD; Phase I Mining Permit; NPDES; Archaeological Site Assessment and Clearance; Right-of-Way permits; Construction permits for sewage treatment plant, potable water treatment plant and the runoff retention dam; and, 404 permit for river bank stabilization activities.

Table 7-5 lists each of the 109 permits/approvals with corresponding acquisition dates.

TABLE 7-5

Permits/Approvals Acquired as of 3/1/84

1. Core Drilling TUP-BLM (8/24/81)
2. Authorization to Drill (shaft core drilling) - Utah Division of Oil, Gas, and Mining (9/15/81)
3. Authorization to Investigate (shaft core drilling) - Utah Division of Water Rights (9/24/81)
4. Endangered Species Biological Assessment/Clearance - USFWS (9/15/81)
5. Temporary Application to Appropriate Water (shaft core drilling) - Utah Division of Water Rights (10/21/81)
6. Approval for Tract Access Road Roadbed Width - Oil Shale Office (10/26/81)
7. Raw Shale Storage TUP-BLM (11/2/81)
8. Authorization for a Test Well (alluvial well exploration) - Utah Division of Water Rights (2/25/82)
9. Temporary Application to Appropriate Water (alluvial well exploration) - Utah Division of Water Rights (2/19/82)
10. NPDES Exemption (alluvial well exploration) - EPA (2/26/82) - verbal approval
11. Construction Permit (alluvial well exploration) - Utah Bureau of Water Pollution Control (2/16/82)
12. Geotechnical Shaft Coring Status Report - Utah Division of Oil, Gas, and Mining (1/28/82)
13. DDP - OSO (3/2/82)
14. Tract Access Road - OSO notification (3/15/82)
15. Tract Access Road - UBAQ notification (3/16/82)
16. Alluvial Well Exploration Plan - OSO (3/22/82)
17. Temporary Application to Appropriate Water (site geotechnical coring and tract access road) - Utah Division of Water Rights (4/2/82)
18. Interim Construction Camp - Uintah County notification (4/8/82)

Permits/Approvals Acquired as of 3/1/84

19. Interim Construction Camp - OSO approval (4/19/82)

20. Site Geotechnical Investigation - OSO approval (4/23/82)

1, 22, 23. Archaeological Clearance for Site 42UN407 - OSO, BLM, Utah Division of State History (4/29/82)

24. Off-tract Geotechnical Investigation - BLM TUP (5/3/82)

5, 26, 27. Use of P-1 Holding Pond for Access Road Construction Water - Verbal approval from Utah Division of Water Rights (5/6/82), Utah Bureau of Water Pollution Control approval (5/6/82), OSO approval (5/11/82)

28, 29. Mine Decline Transfer Point Test Core - OSO Approval (6/8/82)and Utah Division of Oil, Gas and Mining Approval (6/8/82)

30. Exploratory Drilling in Hell's Hole Canyon - Utah Division of Oil, Gas and Mining Approval of Letter of Intention to Commence Exploratory Drilling (6/8/82)

31. Interim Approval for mine related site prep associated with mine access road, production decline and related shaft areas, and mine services building - Utah Division of Oil Gas and Mining (7/8/82)

32. Temporary Application to appropriate water (250 acre-feet, for Phase I construction activities) - Utah Division of Water Rights (7/9/82)

33. OSO Approval for 25,000 yards of borrow for tract access road (7/14/82)

34. Uintah Basin Health Dept. approval of Interim RV Camp sewage system (verbal approval on 7/14/82)

35. Mine Services Building - OSO notification (7/15/82)

36. OSO approval to proceed with mine related site prep as sought in WRSOC's 5/24/82 letter (verbal approval 7/16/82)

37. Mine services building - plan approval from Uintah County Zoning Office (7/22/82)

Permits/Approvals Acquired as of 3/1/84

38. Oil Shale Office approval to revegetate side slopes along the tract access road using WRSOC's proposed seed mix (8/2/82)

39. Approval to proceed with production well program (i.e., 404 permit not required) from U. S. Army Corps of Engineers (8/3/82)

40. OSO notification of plans to drill production wells (8/3/82)

41. Archaeological clearance for production well area and related access road - BLM (8/4/82)

42. PSD Permit - Utah Bureau of Air Quality (8/4/82)

43. Notification of plans to discharge pump test waters directly to White River - OSO (8/9/82)

44. TUP for Northwest Quarter of Southwest Quarter of S15, R24E, T10S - BLM (8/10/82)

45. Notice of Intent to Commence Mining given - MSHA (8/10/82)

46. UDOGM approval for 10,000 yards of borrow from retention pond area (8/13/82)

47. Approval to discharge production well pump test waters directly to the White River - EPA Region VIII (8/19/82)

48. MSHA I.D. No. received (8/23/82)

49. Permit to Drill Production Wells - Utah Division of Water Rights (8/30/82)

50. DOGM Phase I Mining Permit (9/2/82)

51. Permit to discharge production well pump test waters to White River and to use existing holding pond - Utah Bureau of Water Pollution Control (9/8/82)

52. Approval for 13.2 KV Electrical Distribution System - OSO (9/13/82)

53. Approval of Subsidence Mitigation Plan - OSO (9/15/82)

54. County Building Permit for water, sewer and electric utilities exterior to mine services building - Uintah County (9/16/82)

Permits/Approvals Acquired as of 3/1/84

55. Approval for Potable Water System for RV Camp - Uintah County Health Dept. (verbal approval after inspection 9/24/82)

56. Approval for Non-hazardous Solid Waste Disposal Plan - Utah Bureau of Solid Waste (9/30/82)

57. Utah Bureau of Public Drinking Water Approval for Potable Water Distribution System (10/1/82)

58. County Building Permit for Electrical Distribution System (10/16/82)

59. OSO Approval for Sewage Treatment System (10/19/82)

60. UBAQ Approval to Operate Temporary Mine Construction Equipment (10/20/82)

61. Declaration of Exemption for Hell's Hole Sampling Operation - Utah Division of Oil, Gas and Mining (10/20/82)

62. BLM Right-of-Way for Communications Tower on Blue Mountain (10/22/82)

63. Building Permit for Microwave Tower and Equipment Building and Water Truck Loading Facility (10/23/82)

64. OSO Approval for Mining Plans as Described in DDP Update (10/29/82)

65. Utah Bureau of Water Pollution Control Construction Permit for the Runoff Retention Pond and Dam (11/1/82)

66. OSO approval for Runoff Retention Pond and Dam (11/1/82)

67. Utah Bureau of Water Pollution Control Construction Permit for sewage lines and effluent holding pond associated with the RBC sewage treatment facility (11/1/82)

68. Utah Bureau of Water Pollution Control "Conceptual Approval" for the RBC Sewage Treatment Facility (11/1/82)

69. USFWS/BLM Approval of Raptor Protection for 13.2 KV Powerline (11/8/82)

70. Modification to Water Well Layout - OSO (11/12/82)

71. Building Permit for Decline Portal Retaining Wall (11/15/82)

72. FAA Notice of Landing Area Proposal for Helipad (11/15/82)

Permits/Approvals Acquired as of 3/1/84

73. Division of Oil, Gas and Mining Approval for an Additional 30 Acres of Disturbance Beyond 110 (11/30/82)

74. Uintah County Building Permit for Utility System which includes Sewage Treatment Plant, Water Treatment Plant, Substation and Switchgear Plant, and 750 KV Transformer (12/1/82)

75. Construction Permit from Utah Bureau of Public Water Supply for Potable Water Treatment Facility (12/3/82)

76. TUP for Retention Dam and Pond (12/6/82) - BLM

77. Microwave Radio License (received December 7, 1982, effective October 29, 1982) - FCC

78. Uintah County Building Permit for Runoff Retention Pond and Dam and Temporary Structures (12/7/82)

79. Right-of-Way for Retention Pond and Dam (12/10/82) - BLM

80. Uintah County Building Permit for Site Preparation not covered in previous building permits (12/13/82)

81. Uintah County notice indicating that conditional use permit application is complete and adequate (12/20/82)

82. Plan Approval for Runoff Retention Pond and Dam (12/21/82) - Utah State Engineer

83. Utah Bureau of Water Pollution Control Construction Permit for RBC Sewage Treatment System (12/23/82)

84. Utah Bureau of Water Pollution Control Construction Permit for Runoff Retention Pond for Mine Services Building Area (12/23/82)

85. OSO/BLM Approval for Project Signs (12/23/82)

86. County Building Permit for additional mine related temporary structures (1/25/83)

87. UBWPC approval to discharge BNA water quality test waters (1/27/83)

88. Utah Division of State History Archaeological Site Assessment and Clearance (2/1/83)

Permits/Approvals Acquired as of 3/1/84

89. TUP for clay borrow area test pits - BLM (2/4/83)

90. Corp of Engineer's approval to stabilize river bank under the provisions of the Nationwide Permit for Bank Stabilization (2/8/83)

91. OSO approval for Bank Stabilization Plans (2/10/83)

92. DOGM approval to expand limits of work area to 470 acres (2/18/83)

93. Clay Borrow Permit - BLM (3/7/83)

94. Permit to Appropriate Runoff for Retention Dam and Pond - Utah Division of Water Rights (3/25/83)

95. EPA approval to discharge BNA water quality test waters (4/15/83)

96. DOGM notification of decline transfer point service bore hole and access road (4/18/83)

97. Temporary application to appropriate water thru 7/1/84 - Utah Division of Water Rights (4/22/83)

98. Uintah County Building Permit for dryhouse and office trailer (4/26/83)

99. OSO approval for decline transfer point service bore hole and access road (5/6/83)

100. UBAQ approval for installation and operation of 5145 HP of diesel fired electric generating capacity (6/6/83)

101. Uintah County Building Permit for temporary shaft dry house, slope walker shed and diesel generator shed (6/7/83)

102. OSO approval for construction of Visitor Center (6/27/83)

103. Uintah County Building Permit for two temporary generator trailers (7/13/83)

104. Conceptual concurrance for UIC Permit Application-UBWPC (7/13/83)

Permits/Approvals Acquired as of 3/1/84

105. OSO approval for Runoff Retention Dam Monitoring Plan (7/14/83)

106. NPDES Permit for Runoff Retention Dam - EPA (issued 9/27/83, effective 11/2/83).

107. UBWPC Water Quality Certification for Bank Stabilization Activities (11/10/83).

108. OSO approval for Bank Stabilization Activities (11/15/83).

109. Draft 404 Permit for Bank Stabilization Activities - U.S. Army Corps of Engineers (11/28/83).

8.0 ENVIRONMENTAL MONITORING

8.1 Introduction

Environmental characterization and monitoring has proceeded without interruption since the initiation of the baseline program in 1974. In 1982, the program was given new direction by the publication and implementation of the Environmental Monitoring Manual (EMM). The overall program goal stated in the EMM is to detect impacts of oil shale development and determine the cause of those impacts so that corrective measures may be taken if necessary. The EMM added new parameters and/or new monitoring sites to the monitoring program, which resulted in an expanded monitoring program during the 1982-1984 period.

The EMM, and the program defined by it, is a snapshot of what is in reality a dynamic process. Thus, as our knowledge of the environment grows, our understanding of the effects of development increases and as the requirements of various environmental laws, regulations, permit conditions, or lease stipulation change, so too will the emphasis and design of this monitoring program change. It is the intent of WRSOC to maintain a flexible program which addresses current needs.

The major goal of the monitoring program is to provide a body of information which describes the ecology of the project area in a manner which will:

- Allow assessment of changes occurring in the physical and biological characteristics of the tracts as a result of the impact of surface disturbances and pollutant discharges.

- Guide analysis of cause and effect thus leading to appropriate mitigation planning.

- Guide and assess the effectiveness of mitigation and reclamation measures.

This goal will be met by accomplishing the following tasks which are detailed in the manual:

- Describe methods which will be used to document the environmental conditions that exist in the project area.

- Identify candidate monitoring parameters, sites, and schedules based on the probability of impact, importance, legal requirements, measurability, interpretability and cost-effectiveness.

- Develop statistical procedures for detecting and evaluating the degree of impact.

- Develop a quality control/quality assurance program.

- Identify criteria for selection of threshold values for specific parameters.

- Describe the contingency measures to be implemented if the operational monitoring program fails to explain an environmental perturbation.

A substantial effort has been invested in the characterization of baseline conditions for the tract area, especially the identification and quantification of environmental trends. Implementation of the monitoring program is intended to provide the data and the format with which to assess the degree and significance of the environmental effects of project development.

The WRSP monitoring program is driven by the need to identify and evaluate the environmental effects of developing the oil shale resource on Ua and Ub. This involves a full understanding of the physical and chemical processes involved in the mining, processing, and disposal of oil shale and oil shale wastes. However, of equal importance is an understanding of the structure and function of the "ecosystem" into which the WRSP will be fitted. Thus, WRSOC's monitoring program has been developed with recognition of the dynamic interactions between man and nature and within nature itself.

The monitoring program emphasizes those programs which will be implemented to measure environmental changes occurring as a result of project development and provide means of determining cause and effect. To support "field" monitoring efforts, extensive "source" monitoring programs will also be developed to aid in determining "cause". The source monitoring programs are not included in the EMM, but will be designed and implemented as the project develops.

As discussed above, WRSOC has collected continuous environmental data on tracts Ua and Ub since 1974. This data includes air and water quality, terrestrial and aquatic biology and information related to reclamation research. The following sections summarize the monitoring activities which have occurred in these areas during 1982 and 1983. Specific details of the monitoring programs during these years can be found in the following reports: "1982 Progress Report, Environmental Program, White River Shale Project"; and, "1983 Progress Report, Environmental Program, White River Shale Project". The results of the 1984 Environmental Monitoring Program will be published during the second quarter of 1985.

8.2 Summary of Monitoring Activities for 1982 and 1983

8.2.1 1982 Monitoring Activities Summary

The 1982 monitoring program involved six major disciplines, including air resources, vegetation resources, aquatic biology, terrestrial fauna, water resources, and reclamation research studies. The principal goals of the 1982 program were to finalize characterization of baseline conditions and to initiate investigation of tract development related impacts. The following summarizes the results of the 1982 WRSP monitoring program.

Precipitation in 1982 was well above average at the WRSP precipitation monitoring stations. Annual precipitation for the 1982

water year ranged from 13.80 inches to 15.73 inches at WRSP's ten precipitation gauges. The above normal precipitation was primarily the result of several large scale fall and summer storms. Net evaporation for the freeze-free period of May through September was similar to previously collected records and ranged from 24.76 to 27.09 inches.

Streamflow for the White River during 1982 was somewhat above normal at the two in-stream monitoring stations above and below the tracts. The daily discharge of the White River at USGS surface water station 6395 (Stateline) varied from 2720 cubic feet per second (cfs) in May, 1982 to 160 cfs in January, 1982. The 1982 annual runoff for station 6395 was 573,200 acre-feet which is well above the long-term average of 502,300 acre-feet for this station (based upon 56 years of record).

Annual suspended sediment and water quality records for the White River did not indicate any major differences between the upstream station (6395) and the downstream station (6700) during 1982. Nor was there a statistical difference between 1982 records and those of previous years.

Annual runoff and maximum instantaneous discharge for Evacuation Creek near the mouth (station 6430) during 1982 were the highest for eight years of record. This was due to numerous and wide-spread summer precipitation events occurring at higher elevations in the watershed (off-tract to the south). Water quality data were generally similar to previous years' records.

Drywash monitoring continued in the Plant Site Wash (station 6602), Southam Canyon (station 6610), and Asphalt Wash (station 6625). Southam Canyon discharges were higher than normal. Annual runoff for the Plant Site Wash was 7.9 acre-feet. Water quality records for Southam Canyon were similar to data from previous years. Certain water quality records for the Plant Site Wash (noteably suspended sediment, nutrients, iron and nickel) were higher than expected. This is attributed to construction activities in the Plant Site Wash drainage.

Static water level monitoring in Birds' Nest Wells was continued with notable differences detected from previous year records. Uncharacteristic water level fluctuations occurred at Well P-1. This phenomena may have resulted from surface excavation blasting to support construction of a new access road. Also, several Birds' Nest Zone Wells in the northern and western portion of the tracts (P-2 Lower, G-5, G-15 and G-21) continued to show steadily declining water levels. Two additional wells (G-10 and G-11) also began to show declines in 1982. These declining levels, which do not represent significant depletions from storage, were not associated with tract development activities.

The air resources monitoring program at the WRSP continued during 1982 with three sites measuring air quality parameters and five sites measuring macro-meteorological parameters. The air program underwent several modifications during 1982 in response to the construction activities.

The role of monitoring background air quality shifted from site A6 to site A4 because of construction development near A6. Transfer of air quality measurements from A6 to A4 began in April and was completed in July. Air quality measurements at A6 were suspended in September and will not be reinstituted until Phase I operations. Meteorological measurement continued at A6.

Site A10 was relocated and reactivated during 1982 to evaluate impacts of construction during drainage flows. This site monitors total suspended particulate and certain meteorological parameters.

Overall air quality levels during 1982 did not change appreciably from previous years and were generally lower than baseline concentrations. NO/NO_x levels were occasionally higher at A6, probably due to blasting activities near the site. Ozone concentrations peaked at 135 $\mu g/m^3$ in the spring, compared with the national standard of 235 $\mu g/m^3$ and baseline values of 150 $\mu g/m^3$. Particulate concentrations (based upon annual geometric mean) were 14.5 $\mu g/m^3$ compared with the secondary standard of 60 $\mu g/m^3$. The peak 24-hour particulate concentration was 75.9 $\mu g/m^3$ compared with the secondary standard of 150 $\mu g/m^3$.

Sound level measurements also continued at five sites. In areas away from construction activity, natural background levels ranged from 24dB(A) in isolated areas with no wind to 60dB(A)

near the White River. The highest recorded measurement was 75dB(A) and was influenced by construction development.

Biological resource monitoring continued during 1982 with evaluation of vegetation resources, aquatic biology and terrestrial fauna and continuation of the WRSP sponsored reclamation research program. The biological program scope of work followed very closely the plan described in the EMM.

The vegetation monitoring program included eight interrelated tasks to describe the health of tract vegetation and its relationship to biotic and abiotic factors. Annual plant biomass was relatively high in 1982. This parameter appears to correlate better with October-May precipitation than strictly spring (April-June) precipitation. Production and annual cover of annuals ranged from 68.1 gm/m^2 and 18.2% for Riparian areas to 0.4 gm/m^2 and 0.2% for Juniper areas.

Sagebrush stem leader growth was low during 1982 despite good fall-winter precipitation. While this is within the 95% prediction interval established by the regression equation (determined based upon seven years of data), further evaluation of this finding is required.

In other vegetation studies, sagebrush leaders were analyzed for nine trace elements to define a natural background for these compounds which may be associated with emissions from the WRSP. Litterfall measurements were continued, with a six fold increase

in the number of litter traps, to assess the vigor of seven dominant floral species and provide information on nutrient cycling and food resource recharge. A study was also begun using Cole Browse Survey methods to assess utilization of plants by animals. Also, color infrared aerial photographs were taken to assess plant condition and stress. The 1:2400 scale was determined to be the most appropriate in measuring vegetation stress in sparsely vegetated areas.

Lichen monitoring also continued at 21 stands along three transects extending outward from the plant site. An elemental analysis was conducted on saxicolous lichen to establish a baseline for these parameters. Continued lichen monitoring will emphasize total cryptogamic cover, number of species/quadrat, and sulfur content of lichen tissue.

Soil microbiology and soil chemistry analysis were also conducted. While soil pH, organic carbon, and conductivity levels did not vary over the year or between sites, soil moisture showed a high in February and a low in June. Soil bacteria and respiration rates correlated well with soil moisture levels.

Aquatic biology monitoring during 1982 was a continuation of the program reestablished at the WRSP in 1981. During 1982 biological conditions in the White River were dominated by physical factors. Production was very low compared to 1981 due to high river levels, frequently high suspended sediment levels, and reduced light penetration occurring as a result of thunderstorm

activity. The high river flows also contributed to temporal changes in nutrient levels.

An investigation of the role of metals in the White River was begun. Generally, metal levels in White River biota were found to be higher than the literature shows for other river systems in non-industrialized areas. The input from Evacuation creek and the proximity of oil shale and marlstone outcrops are probable causes for these naturally occurring high levels. The aquatic system is well adjusted to this condition.

Also, work continued on the P/R chambers and leafpack systems. These developing in-situ monitoring tools will allow rapid analysis of production, respiration and decomposition rates which are key to evaluating the health of the aquatic system.

Five major groups of terrestrial fauna were emphasized during 1982. These included soil invertebrates, foliage invertebrates, reptiles, birds, and mammals.

Soil invertebrate parameters differed significantly among the sampling sessions during 1982 in response to the changing climatic conditions. Foliage invertebrates likewise varied with climatic conditions but also with plant phenology and production. Amphibian and reptile populations showed declines from previous years due to generally wet conditions in the winter and fall and a relatively cool spring. The riparian area was the exception where increasing reptile population was noted.

Bird populations declined in all habitats except riparian in 1982. This is apparently due to low spring precipitation. The riparian bird population increased in response to higher food availability near the river as high flows increased habitat for insect production. In February, ten bald eagles were surveyed wintering near Tracts Ua and Ub. A total of 58 raptor nests involving seven species were located in a 55 square mile area on or near the tracts. Eleven nests were active, including three golden eagle nests.

Mammal populations generally increased in most habitats, especially riparian. This appears to be related to abundant fall precipitation. Mule deer populations remain low with mean herd sizes ranging from two to six per siting.

Reclamation research continued during 1982 with both greenhouse and field studies in progress. The research completed to date has provided information pertinent to revegetation of both disturbed and processed shale areas. Plant species have been identified and methodologies listed which provide valuable direction in meeting the reclamation requirements of the Prototype leases.

Annual plant succession studies on processed shale at Anvil Points, Colorado began in 1981 and are yielding valuable information on means of rapid initial stabilization of the surface of processed shale and the reestablishment of organic matter. Root growth studies in processed shale, begun in 1979, continue to

show spreading of healthy roots from soil trenches into processed shale. Soil and plant tissue studies analyze plant tolerance levels to salt buildup. Plant establishment test plots on both disturbed areas and processed shale continue to show high survival rates for many species.

Recently initiated studies include establishment of a topsoil stockpile to investigate changes in microbiology that may occur with long-term storage and to evaluate methods of pile stabilization. Also, a study is continuing to assess various methods for enhancing wildlife habitat.

Greenhouse studies were initiated in 1982 to investigate the physical and chemical properties of circular grate processed shale and the response of seed germination and growth of those characteristics.

8.2.2 1983 Monitoring Activities Summary

The 1983 ambient environmental monitoring program involved six major disciplines including air resources, vegetation resources, aquatic biology, terrestrial fauna, water resources and reclamation research. Work also began to integrate information generated within these disciplines and to refine the overall WRSP monitoring program. This initial effort is entitled "Ecosystem Analysis". A principal goal of the 1983 monitoring program was to continue investigation of tract development related impacts.

The following summarizes the results of the 1983 program.

The air resources monitoring program during 1983 continued with macrometeorology measurements at five sites and air quality measurements at two sites. No major changes were made to the program during the year. Site A4 south of the tracts continued to function as the primary background station after assuming that role from Site A6 during 1982 following the initiation of construction activities on tract.

Meteorologically, as well as climatologically, 1983 was an unusual year. The summer was accompanied by lower winds with less turbulence, lower temperatures, higher humidities and less net radiation than normal. The winter was accompanied by increased storminess as seen in lower average barometric pressure and higher relative humidity.

Air quality at the WRSP during 1983 was generally comparable to values measured during the baseline period and reflect conditions typical for a remote rural area. As in previous years, ozone and total suspended particulate (TSP) concentrations exhibited a natural, non-zero background level. The peak 24-hour ozone level, during 1983 was 142 $\mu g/m^3$ compared to the national standard of 235 $\mu g/m^3$ and a peak baseline value of 163 $\mu g/m^3$ measured in May, 1977. The maximum 24-hour average TSP levels at sites A4 and A10 during the year were 71.9 $\mu g/m^3$ and 74.7 $\mu g/m^3$, respectively. These levels occurred the same day on which the winds were high; however, they are only about

50 percent of the national secondary standard and about 60 percent of the previous maximums measured on tract. All other measured parameters (CO, SO_2, and NO_x) were present at levels approaching the lower limit of detection. Peak CO levels reached 25 percent of the eight-hour standard due probably to zero drift problems with the instrument.

South level measurements continued at six sites. Background sites recorded near-baseline levels of 20-40 dB(A) at remote sites and 20-50 dB(A) near the White River. Sites impacted by construction measured up to 75 dB(A).

Precipitation in 1983 was above average at the WRSP monitoring sites. Annual precipitation for the water year ranged from 11.5 inches at the plant site (ARA-13) to 14.9 inches south of the tracts (RA-4) and averaged 13.7 inches for the 10-station network. While the 1983 precipitation total was the second highest recorded by the WRSP monitoring program, no unusual precipitation intensities were measured. The most intense rainfall event of the year was representative of a two-year return interval storm. Total pan evaporation for the freeze-free period of May through September was similar to previous measurements at 24.37 inches. This data was collected at a new site (EVP-9) in Upper Southam Canyon which was relocated during 1983 to coincide with sites used for biological data collection.

Mean annual streamflow at White River station 6700 below Asphalt Wash during 1983 was the highest observed during the 9 year

history of the WRSP monitoring program. In fact, the 1983 annual streamflow was the second highest for the complete period of record (1924-1979) based upon data from station 6500 on the White River near the Ignatio Bridge. High flows in the White River occurred from late-May through early-August due to upper basin runoff associated with an unusually heavy snowpack in the mountains. The 1983 annual runoff at station 6395 (stateline) was 818,862 acre-feet compared in the long-term average of 502,300 acre-feet for this site. The daily discharge at station 6395 during 1983 varied from 220 cubic feet per second (cfs) to 5820 cfs.

Suspended sediment levels and several water quality parameters measured at station 6700 were above previously observed values. However, it was concluded that the higher values were natural occurrences related to high snowmelt conditions not previously encountered during the monitoring program. The only significant difference in water quality between concurrent samples collected at station 6395 above the tracts and station 6700 below the tracts was attributed to an incidence of runoff from Evacuation Creek, located between the two White River stations, containing high total dissolved solids.

Annual streamflow at station 6430 near the mouth of Evacuation Creek exceeded the mean discharge for the 8-year record of the WRSP monitoring program for that station by a factor of five. The high streamflow was the direct result of high snowmelt and numerous intense summer thunderstorms in the Evacuation Creek

drainage basin. Suspended sediment and water quality data for station 6430 were typical of previous records.

Drywash monitoring continued at the plant site (station 6602), the mouth of Southam Canyon (station 6610), and the mouth of Asphalt Wash (station 6625). Station 6605 in upper Southam Canyon at the southern boundary of Tract Ua has been reactivated and operated through 1983. With completion of the runoff retention dam and pond, drainage area above station 6602 was reduced substantially. Annual runoff from Southam Canyon at station 6610 was near the mean for the 8-year WRSP monitoring program. However, a peak flow measurement resulting from one summer thunderstorm resulted in the highest recorded flow event of the program (440 cfs). Surface flow at station 6625 was well below the mean for the total program. Water quality records from the dry washes did not show changes from previous values.

Biological resource monitoring continued during 1983. The program included evaluation of vegetation resources, aquatic biology and terrestrial fauna. The WRSOC also continued to sponsor reclamation research activities during 1983 as well.

The vegetation monitoring program included nine interrelated tasks designed to document existing conditions, discern interactions between biotic and abiotic factors relating to vegetation, and evaluate impacts of development and reclamation success. Production of annual plant biomass was very high during 1983, being exceeded only by levels measured in 1975. Produc-

tion and annual cover values ranged from 1.2 g/m^2 and 0.4% for juniper areas to 116.4 g/m^2 and 14.9% for riparian areas.

Growing conditions for sagebrush during 1983 were very good as reflected in higher than average stem growth. Animal use of sagebrush assessed by the Cole Browse Survey showed minimal use. Overall animal use of shrubs was substantially lower in 1983 (18% use) than in 1982 (51% use).

In other vegetation studies, sagebrush leaders were analysed for nine trace elements expected to be associated with WRSP operations. All values showed levels within the normal range of concentrations for desert plants. Litterfall measurements continued during 1983. Litterfall was highest for shadscale and lowest for fourwind saltbush. Aerial color infrared photographs were taken at 1:2400 along three transects to evaluate plant condition and stress. Data from 1982 and 1983 were not measureably different and establish a good baseline for future efforts.

Lichen monitoring continued at 21 permanent stands located along three transects radiating from the plant site. Parameters found to be good indicators of current conditions and potentially valuable for monitoring impacts include total cryptogamic cover, number of species/quadrat, and frequency of eight key lichen species.

Soil microbiology and soil chemistry analyses continued at eight sites within the four principal vegetation types occurring on tract. Correlations between counts, total fungi, dehydrogenase, and microbial respiration levels were associated with moist soils while bacterial numbers and activities tended to be positively correlated with organic matter.

Also, during 1983 several monitoring sites were established along the tract access road between Duck Rock and the plant site to evaluate the success of revegetation efforts which bagan in 1982. The revegetation program involved the use of both seeding and transplanting techniques. An initial survey of transplants in June, 1983 showed 85% survival with sagebrush survival the highest (96%) and rabbitbrush the lowest (50%). However, because of high herbivore populations, by October survival of sagebrush had declined to 36% and no living transplants of fourwing saltbush, rabbitbrush or shadscale were located along any transect.

Seeding success during 1983 was excellent. The average density in October of all plots on all sites was 9.6 plants/m^2 which is classified as excellent for the Intermountain area. Sagebrush was the most common species, followed by western wheatgrass and fourwing saltbush. Seeding success can be attributed to favorable moisture conditions during 1983.

Aquatic biology monitoring continued during 1983 in the White River. Experiments were conducted to define the variability of important parameters to determine if cross-stream transects were statistically appropriate to characterize riverine conditions. Experiments were also undertaken to increase the program's sensitivity to macroinvertebrate parameters.

Due to elevated flows in the White River during 1983, river habitats changed significantly. WRSP transect WR27 below Asphalt Wash was altered from a shallow riffle to a deep, swift run. Instantaneous water quality parameters, particularly nitrogen and phosphorus nutrients, were elevated over values noted in 1981 and 1982. Primary production was severely limited due to the low levels of light penetration during much of the year. Comparisons of biological parameters for control (WR03) and treatment (WR18) sites showed that chlorophyll a and macroinvertebrate numbers and biomass were not significantly different and thus were responding similarly. WR27, due to its altered state, was different from both upstream sites.

A metals study was also conducted in the White River adjacent to the tracts for the purpose of establishing a baseline for this parameter. Further, the study also investigated the mechanisms regulating heavy metals' dynamics in the White River. The study showed high natural metal levels in the river existing at this time, a spatial correlation between river and alluvial water quality, adaption of organisms in the river to high metal loadings, and that adsorption of metals by suspended sediments is a

major natural mechanism for removal of metals from the soluable form.

In the terrestrial fauna program, four major groups were sampled in 1983. These included foliage invertebrates, reptiles, birds, and mammals. In addition, a special study was begun to detail interrelationships among vegetation, soils, seed production and rodent abundance and distribution.

Foliage invertebrates showed a significant increase from 1982 to 1983 on big sagebrush and varied with soil water potential. Four various host plants variations in invertebrate richness and diveristy were related to lead water potential. Variations in reptile species values were inversely related to annual plant productivity at individual sampling sites. No impacts due to the project were noted on reptile populations.

Five aspects of the bird community were studied during 1983 including spring migratory birds, breeding birds, waterfowl, raptors, and endangered species. Twenty active raptor nests were located during the year as compared to 12 nests in 1982. Golden eagles (seven active nests) and red-tailed hawks (seven active nests) were the most common breeders in 1983. Breeding success was very high for all species due probably to abundant food (i.e., desert cottontails and montane voles) and moderate temperatures. During surveys along the White River in February, 1983, 26 bald eagles were counted versus 10 in 1982.

Thirty three species of mammals were noted during 1983 surveys. Rodent populations did not change appreciably at most trapping sites. Montane voles were found in abundance on alluvial deposits near the White River while previous year's surveys produced only limited sitings. Mule deer were more common in 1983 than in previous years, but populations remain relatively low. Bighorn sheep were observed for the first time since monitoring began in 1974 near Asphalt Wash and near Ignatio Bridge.

Reclamation research conducted in 1983 continued at sites previously established at Anvil Points, Colorado and at the WRSP Section 6 study site. Topsoil related research was initiated on a large topsoil stockpile near the mine services building at the plant site. A report was prepared on laboratory and greenhouse studies on circular grate processed shale initiated in late 1982. The WRSP research program is intended to support the WRSP's plans for reclamation of disturbed areas and processed shale.

The Anvil Points studies continued to show successful establishment of plants on processed shale. Root growth into processed shale continued with no significant differences between root volumes in topsoil samples and those in processed shale. Plant survival in the fifth year of study at Anvil Points remains high. Both plant height and cover values were higher in 1983 than previous years. Annual plant succession studies which had shown promising results were discontinued at Anvil Points as the

site was disturbed by construction activities.

Studies continued at Section 6 to investigate habitat enhancement through interplanting and interseeding. High herbivore populations caused substantial losses for unprotected plants. However, for those plants protected by an artificial covering, survival exceeded 99%.

Topsoil studies at the plant site consisted of testing seeding success with various fertilizer application rates. Information gathered will be important for erosion control and stockpile stabilization and for the maintenance of important soil biological characteristics.

During 1983 the WRSOC initiated an internal effort entitled Ecosysem Analysis which was intended to integrate information generated by the five primary monitoring disciplines and to maintain overall program focus on identification of project impacts. Because of limited time and resources, ecosystem level analysis conducted during 1983 focused on the identification and testing of relationships among climatic, pedogenic (soil), and certain floristic parameters.

8.3 Data Management

As a condition of the Environmental Stipulations to the Oil Shale Leases for Tracts Ua and Ub, it is necessary to conduct inter- and intra-disciplinary analyses of monitoring data and evaluate ecosystem

relationships which are found to exist. During 1983, WRSOC executed a contract with Ecosystem Research Institute (ERI) to conduct data management and analysis and provide program recommendations. As a result of this contract, all monitoring data through 1982 was integrated into a central library and is either on active disc storage or tape.

As of March 1, 1984, work was proceeding on cataloging available 1983 monitoring data. This work will be complete by the second quarter of 1984.

During 1983, WRSOC conducted through ERI the first major data analysis effort for the environmental monitoring program. The results of this program were presented in the "1983 Progress Report, Environmental Program, White River Shale Project" in chapter 8 which is entitled "Ecosystem Analysis".

9.0 HEALTH, SAFETY AND SECURITY

9.1 Mine Health and Safety

9.1.1 Dust Control

During the mine construction period, the primary means of dust control in the underground areas consisted of mechanical ventilation and wetting with water sprays. In the production decline, roadways were wetted as needed to reduce dust. In the face area, dust generated during excavation was collected in ventilation tubing and subsequently exhausted out of the mine. Ventilation was accomplished by a 75 HP fan exhausting to the surface through a five-foot diameter bore hole and a 75 HP in-line booster fan. Total volume was 55,000 CFM.

The shaft and associated development were ventilated by two 75 HP surface fans and two 50 HP auxilliary fans underground. Total volume of intake air was 57,300 CFM.

9.1.2 Gassy Mine Conditions

As required by the DDP, permissible equipment was used in both the shaft and decline after excavation reached an elevation of 4,661 feet. Sufficient ventilation was maintained to dilute and render harmless the volume of methane released into the work areas.

During the shaft development, methane was detected in sufficient quantities for MSHA to classify the mine as "gassy". Methane checks and ventilation surveys were performed as required by MSHA gassy mine regulations. In addition, methane levels were continuously monitored by remote sampling from equipment installed on surface.

During the March 1, 1982 through March 1, 1984 report period, methane was not detected in the decline in sufficient amounts to warrant a "gassy" classification by MSHA. However, as a precautionary measure, methane checks and ventilation surveys were conducted as per MSHA regulations. In addition to manual methane sampling, a continuous monitor was installed on the Paurat mining machine that gives an audible warning when levels reach 1.0 percent and automatically shuts the machine down if levels reach 1.5 percent.

9.1.3 General Safety Practices

A continuous effort was made during the reporting period to operate the WRSP construction site in a manner that minimizes to the extent reasonable the risks to the safety of the people at the construction site. As a minimum, this effort is compatible with accepted industry practice and complies with regulatory requirements. Safety inspections were regularly conducted jointly, as well as individually, by WRSOC, Parsons, and Frontier-Kemper. Also, safety items were frequently discussed in the formal weekly meeting of the three owner companies.

9.1.4 Safety Training

During the shaft sinking and construction phase, MSHA regulations do not require formal structured training programs for employees. Usually, the training given employees by the contractors and subcontractors is dictated by their needs and company policies. The recommendation of WRSOC was that a minimum of eight hours of classroom training be given to employees annually, in addition to the other necessary on-the-job type task training. The main subcontractor on site (Frontier-Kemper) has complied with that recommendation.

9.1.5 Medical Facilities

During the mine construction phase of the WRSP, a certified emergency medical technician (EMT) was kept on each shift. In addition, employees were trained in first aid.

An emergency vehicle, equipped to meet State standards for ambulances, is provided to transport anyone injured and able to to be treated in the local facilities. For serious injuries, arrangements exist to have the victims transported by helicopter to Grand Junction or Salt Lake City.

9.1.6 Safety Record

A meaningful measure of the effectiveness of a safety program is the Incident Rate (IR) which was developed by MSHA. The IR

represents the number of lost time injuries per 200,000 hours of employee exposure. The following statistics, complied by MSHA, present a comparison of the WRSP contractors experience with the national average IR for metal and non-metal mines.

INCIDENT RATES

	Fatalities*		Lost Time Accidents**	
	National Average	WRSP	National Average	WRSP***
1st Quarter 1983	0.11	0.00	5.66	9.57
2nd Quarter 1983	0.05	0.00	5.41	0.00
3rd Quarter 1983	0.02	0.00	5.65	0.00
4th Quarter 1983	0.09	0.00	5.06	0.00
1st Quarter 1984	0.16	0.00	4.50	0.00

* Number of fatalities per 200,000 hours worked.
** Number of accidents per 200,000 hours worked.
*** WRSP contractors

WRSOC employed a safety supervisor on January 1, 1983. The statistics of 1st quarter 1983 reflect the period of time spent in evaluating the safety needs of the project and implementing procedures to reduce accidents.

During the construction phase, accident rates are traditionally higher than the national average. The statistics for the time periods after the 1st quarter 1983 represent a successful combined effort by WRSOC and its contractors to break that tradition.

9.1.7 MSHA Inspections and Citations

The following presents a summary of MSHA inspections at the WRSP mine:

MSHA INSPECTION HISTORY (January, 1983 - March 1, 1984)

Date	Number of Citations	Date	Number of Citations
(1983)			
1/11	0	10/04	0
1/18	0	11/01	0
1/19	0	11/02	0
1/20	1	11/29	0
2/01	0	11/30	0
2/02	0	12/01	3
2/03	0	12/05	0
2/08	0	12/06	0
2/09	0	12/07	0
2/10	1	12/19	1
2/16	0	12/20	3
3/02	0	(1984)	
4/06	2	1/17	0
4/07	0	1/18	0
4/18	0	1/31	1
4/19	0	2/28	0
4/20	0		
5/09	3		
5/10	0		
5/11	0		
5/12	0		
7/18	2		
7/19	0		
7/20	0		
8/23	0		
8/24	0		
8/25	0		
9/07	0		
9/13	0		
9/14	0		
9/15	2		
10/03	0		

In summary, WRSP contractors had 47 inspection days by MSHA during the January, 1983 - March 1, 1984 period. From those inspections, there were 19 citations issued. However, the citations issued can be classified as routine and relatively non-serious; as often occur at a construction site which is continually in a state of change. MSHA has never issued citations or cease work orders for imminent danger or hazardous conditions.

9.1.8 Emergency Plan

During the March 1, 1982 through March 1, 1984 period, WRSOC developed and implemented an emergency plan that outlined the course of action to be taken by site personnel in the event of a mine fire or other emergency situations at the project. Some of the key areas addressed in the plan were:

1. Notification of key site personnel.
2. Assignment of personnel to management and coordination teams.
3. Notification of corporate office.
4. Procedures for news release.
5. Procedures for site security.
6. Assigned responsibilities for procurement of materials, food, etc.
7. Personnel to notify and assist mine rescue teams.

9.2 Security Systems

During 1983, the Owners of the WRSP prepared a report which analyzed the overall security situation at the WRSP site. The Owners' report was reviewed by WRSOC and those portions that addressed the WRSP's current needs, as related to the level of activity on site, were implemented. Should the scope of work change, the Owners' reports will serve as a guide to establish the appropriate degree of security.

9.2.1 Plant Entrance Security

A Security Building was erected to serve as a security checkpoint. The building was located on the highway at the plant entrance (approximately 1.9 miles beyond the Baxter Pass exit). Entry signs were posted at this checkpoint informing entrants of the provisions of search and of items not allowed on the project. In addition, fencing and gates were installed on "back entrance" roads to the WRSP construction site. Keys were available at the security checkpoint for individuals with legitimate needs to cross through the gates.

9.2.2 General Security Procedures

As part of WRSOC's General Security Procedures, an identification badge system was developed and implemented for site personnel. In addition, logs were kept by the guard stationed in the Security Building, which were used to record visitors, site deliveries and other miscellaneous occurrances. A "Release of Liability Statement" was also required of each visitor to the WRSP site.

As part of the WRSP site security procedures, security guards conducted random patrols of the plant site area as well as random vehicle searches.

10.0 WATER AND ELECTRIC POWER ACQUISITION ACTIVITIES

10.1 Water Resources Development

Work continued during the period March 1982 to March 1984 on securing a source of water for the development of Tracts Ua and Ub. This work primarily involved continued discussions and negotiations with the State of Utah concerning the construction of the proposed White River Dam and Reservoir. Continuing studies and evaluation of other alternatives confirmed the conclusion that the proposed White River Dam and Reservoir is the best approach to supplying water for the WRSP.

The primary product of the work during the reporting period involved the completion of an updated Water Supply Alternative Study and the execution of an agreement for the purchase of water from the State of Utah. The "White River Shale Project Water Supply Alternative Study" was completed in August 1983. The agreement with the State of Utah for use of up to 3,000 acre feet per year of water was executed effective September 2, 1983.

The Water Purchase Agreement with the State of Utah represents a major step forward in the water supply program of the WRSP. The Owners of the WRSP paid the State of Utah $100,000 as part of the agreement. This payment pays for the use of up to 3,000 acre feet per year of State of Utah water through the year 1989. Starting in 1990 water will be purchased at a price stipulated in the agreement. The term of the agreement is through the year 2012 unless it is earlier terminated by the Owners of the WRSP or the completion of the White River Dam Project

by the State of Utah with the availability of water from that project at competitive prices which equal those offered to all other similarly situated industrial water use customers who are purchasing water from the White River Dam project.

The Water Purchase Agreement acknowledges that the State of Utah is diligently working toward solving the various problems regarding the construction of the White River Dam project or other alternate projects for the storage of White River water. The agreement further notes that the White River Dam project, because of its proximity to Tracts Ua and Ub, is a desirable water supply for development of that property and therefore both parties agree to use their best efforts to accomplish the construction of the White River Dam project.

The agreement, however, does not create any rights or obligations on the part of either party in regard to the White River Dam project. Any such rights and obligations would be the subject of a separate agreement to be negotiated at the time the White River Dam project is to be constructed. It is currently the intent of the Owners of the WRSP to replace the existing Water Purchase Agreement with an agreement to purchase water from the proposed White River Dam and Reservoir project.

The water that the State of Utah has included in the 1983 Water Purchase Agreement is available through an approved segregation application (#36979-aa). The 3,000 acre feet represented by this approved segregation application is part of the 105,000 acre feet unapproved segregation application #36979-a. The 105,000 acre feet is in turn part of the original 250,000 acre feet unapproved water right applica-

tion that has a priority date of May 19, 1965. This original application contemplated use of the water for oil shale development, municipal and domestic applications and included an amount for nonconsumptive use in regard to generating hydroelectric power.

Through March 1984, water has been used in regard to construction activities on Tracts Ua and Ub. This water was originally used under a temporary water use permit issued by the Utah State Engineer's office. Effective September 1983, water was being used under the Water Purchase Agreement executed between the State of Utah and the White River Shale Oil Corporation. This water was utilized through a system of two alluvial wells located at a point on the White River almost directly north of the WRSP construction site.

10.2 Electric Power Development

Several important accomplishments were made during the reporting period in regard to securing the necessary power for the WRSP. These included construction of a temporary power line to provide much of the power for construction activities, the balance being provided by on-site diesel generation of electric power. (See section 3.5.9)

The most important accomplishment, however, was the execution of an electric service agreement between Utah Power & Light Company and the WRSOC as agent for Sohio Shale Oil Company, Sun Shale Oil Company, and Phillips Petroleum Company. This agreement was entered into on November 21, 1983. The agreement provides for delivery of up to 38 megawatts of power. This amount of power is considered adequate

for the commercial facilities currently planned by the Owners of the WRSP. Right-of-way application for the routes to be used to provide power to Tracts Ua and Ub were submitted in 1983. Much of the engineering work for the power lines was completed.

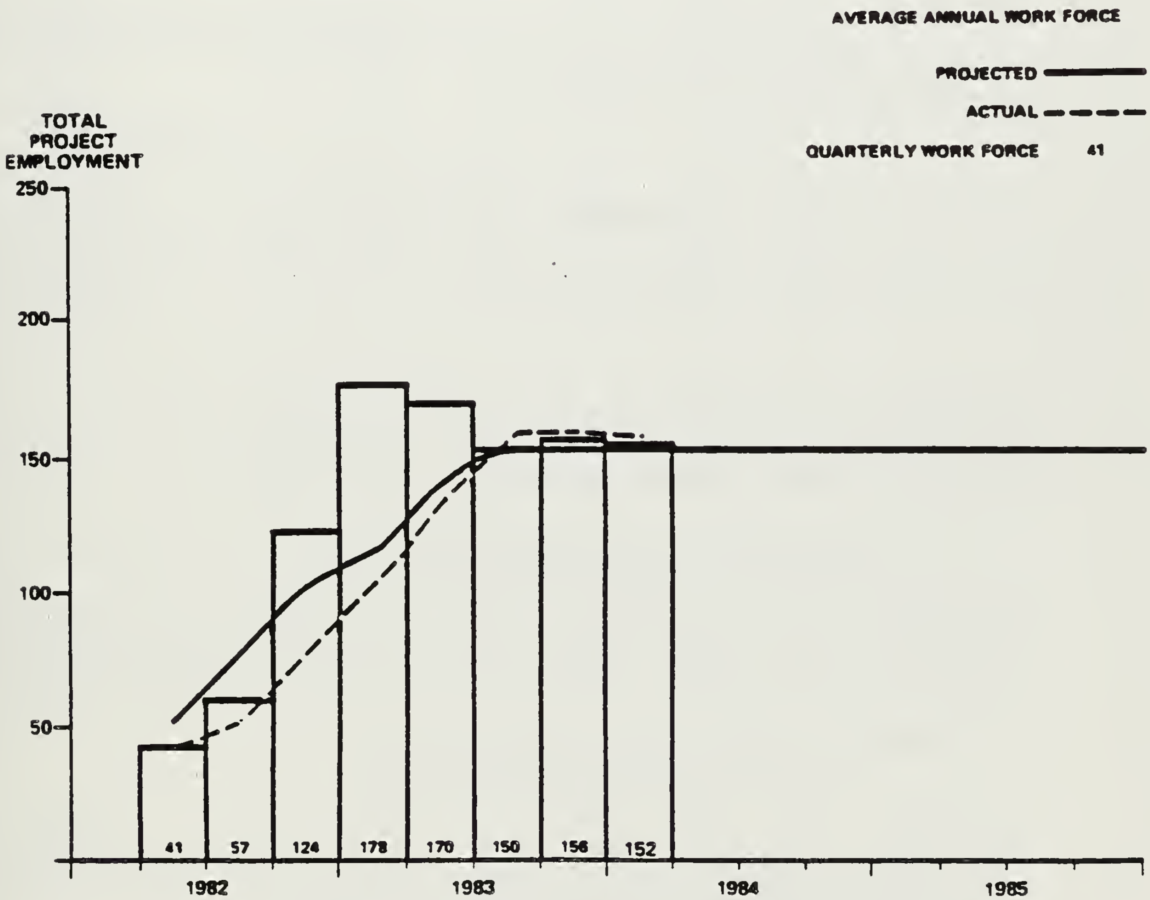
Work on completing the design, receiving the necessary rights-of-way from the Bureau of Land Management, and initiating construction, ceased the first part of 1984 after the Public Service Commission ordered UP&L to stop all activities related to providing power to the WRSP. This work will not proceed until resolution of the issues concerning the right of the Utah Power & Light Company to serve the Owners of the WRSP. This matter is currently under appeal to the Supreme Court of the State of Utah.

Resolution of this issue does not affect the completion of the construction activities planned for 1984, nor will it affect the ongoing operations contemplated over the next several years.

11.0 SOCIOECONOMIC ACTIVITIES

11.1 Workforce

The workforce on the White River Shale project has been monitored continuously since March, 1982. Workforce projections are required in the Detailed Development Plan and a "Projected vs. Actual" graphic is useful information for both corporate and governmental officials. Shown below is the projected and actual workforce for the March 1982-March 1984 time period.



The expectation was that the average annual workforce would not exceed 150 during the initial construction and mine development phase. The above chart shows that the projected employment was very near to the actual employment.

11.2 Monitoring Program

In early 1982, WRSOC submitted and the Oil Shale Office approved a socioeconomic monitoring program. The program was implemented when construction and mine development activities were intiated. The first quarterly monitoring report was sent to local governments and state and federal agencies in July, 1983.

Since that time socioeconomic monitoring reports have been prepared and distributed on a quarterly basis.

Socioeconomic information is collected by having each employee complete an identification badge form before a security badge is issued. Information that is collected includes: age, local address, permanent address, job title, number of children residing with worker, marital status, prior employment status, type of housing, and recreational interests.

To ensure accuracy of data, employee lists are reviewed quarterly with sub-contractors, and all information is updated by each employee at the end of each year.

The employee monitoring program has provided extremely useful planning data to the local communities. A significant question before the White River Shale Project began construction was in which community employees would choose to live. Other socioeconomic and demographic questions have become more clear because of the monitoring data.

Shown below is selected data from the quarterly reports:

	1982 2nd Qtr.	1982 3rd Qtr.	1982 4th Qtr.	1983 1st Qtr.	1983 2nd Qtr.	1983 3rd Qtr.	1983 4th Qtr.	1984 1st Qtr.
% of WRSP Workers Residing in Local Communities**								
Jensen	5	7	5	4	3	4	4	3
Maeser	0	2	7	6	6	8	7	5
Naples	5	3	5	7	7	7	10	7
Vernal	59	49	45	43	46	51	48	49
Other Ashley Valley	*	*	2	13	16	17	22	23
LaPoint	0	0	0	0	1	1	1	1
Roosevelt	0	0	5	0	0	1	0	0
On-Site	19	25	19	17	16	6	4	5
Dinosaur	5	9	2	1	1	1	1	2
Rangely	7	5	2	0	0	1	0	0

	1982 2nd Qtr.	1982 3rd Qtr.	1982 4th Qtr.	1983 1st Qtr.	1983 2nd Qtr.	1983 3rd Qtr.	1983 4th Qtr.	1984 1st Qtr.
Marital Status of WRSP Workers (%) **								
Single	32	26	16	19	16	16	18	18
Single-Status	32	40	38	33	32	27	15	15
Married	36	33	44	46	51	57	67	67
Local/Nonlocal designation (%) **								
Local	37	28	35	38	21	18	17	18
Nonlocal	63	72	64	58	79	82	83	82
Type of Housing Utilized by Workers (%) **								
Single Family	20	18	23	35	35	37	38	37
Apt./Condo.	7	10	10	12	24	31	31	30
Mobile Home	20	18	11	11	9	9	18	18
RV	54	54	32	20	18	10	8	10
Motel	0	0	20	17	11	9	3	3

11.3 Housing

Housing for the mine development phase of the project was accomplished using two approaches: 1) the construction and utilization of temporary housing (RV pads) in the field, and; 2) the utilization of existing housing in the local communities.

Both approaches worked well. The RV pads, located on Tract U-b, were occupied by the temporary construction employees that were building the access road, preparing the site, and constructing the mine services building. The mining contractor's employees, for the most part, utilized existing housing stock in the community.

A "Housing Master Plan" was prepared during 1983 by the White River Shale Oil Corporation. The Plan illustrated in some detail how and where the WRSP workers would be housed. The Plan included an actual census of existing and platted housing, the number of additional units required as a result of WRSP, and projections related to timing and size of the WRSP construction camp. A housing strategy was developed from the Master Plan which showed the approximate timing, nature, and number of units required if the WRSP developed according to DDP schedules.

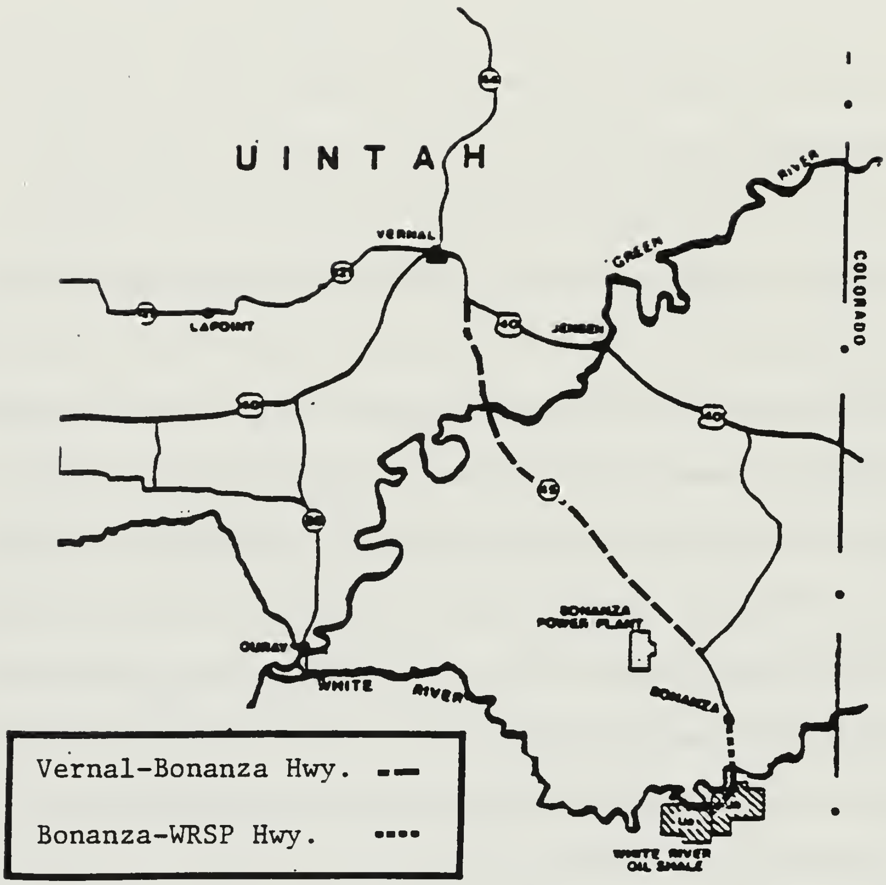
Beginning in the 3rd Quarter of 1983, active monitoring of housing in the Ashley Valley was initiated and presented in the quarterly monitoring reports. Various types of housing are monitored, including apartments, condominium projects, hotels, and mobile home parks, with accompanying data on occupancy rates and rental prices. The housing

monitoring program has been useful and informative to local governments, private developers, and corporate officials.

The owners of the WRSP, in the spring of 1981, purchased 727 acres of land approximately 5 miles south and east of Vernal. The acreage may be developed in the future as residential property and would coincide with project development.

11.4 Transportation

A major construction activity in 1982 for both WRSOC and Uintah County was the construction of access roads that lead to the Bonanza Power Plant and the White River Shale Project. A new two-lane highway was built by Uintah County using private contributions and state assistance and extends from Vernal to a point seven miles north of Bonanza, Utah. Beginning at Bonanza, WRSOC built a new two-lane road that reaches to the WRSP mine development site and included a new bridge across the White River that was partially funded by the Utah Board of Water Resources. WRSOC has Uintah County build the bridge and part of the road. Construction of the system was completed by the end of 1982. (See illustration below.)


UINTAH
VERNAL
LAPOINT
JENSEN
GREEN
RIVER
COLORADO
OURAY
WHITE
RIVER
BONANZA
POWER PLANT
BONANZA
WHITE RIVER
OIL SHALE
Vernal-Bonanza Hwy.
Bonanza-WRSP Hwy.

11.5 Impact Analysis and Mitigation

11.5.1 Policies

The following general principles on impact analysis and mitigation were developed by WRSOC and distributed to local, state and federal governments.

1. Close communication is needed between local communities impacted by a project and WRSOC to ensure that local government and private sector plans are consistent with project commitments.

2. WRSOC believes existing impact mitigation funding mechanisms that have been established by the U. S. Congress and the Utah Legislature should be used to the maximum extent possible to assist communities impacted by a project. We also believe it will be necessary for affected entities to fully explore other mechanisms available to them and to utilize those mechanisms to the extent possible to address their current needs and expected impacts.

3. A time lag between the financial impact on communities and the receipt of additional tax revenues from a project may cause temporary front-end financing problems for those communities. Impact mitigation programs should be designed to alleviate these revenue-timing problems with the recognition that such assistance should be temporary and provided

only until the impacted entity can reasonably be expected to carry forth alone with its responsibilities.

4. Temporary facilities and services should be used, to the extent possible, to handle impacts caused by temporary population peaks. Permanent facilities and service-levels should be based on permanent population growth.

5. WRSOC will not alleviate the impacts caused by other sources of growth or existing deficiencies in current facilities or services. When existing residents benefit from new facilities or improved service levels, they should bear a proportionate share of the cost.

6. Assistance provided by WRSOC should be handled in such a manner as to ensure such assistance is utilized to mitigate identified and specified needs. Assistance should be on a modular basis; i.e., socio-economic commitments should be made to identifiable project stages, wherever possible.

11.5.2 Studies

WRSOC has prepared and submitted to governmental entities a number of socioeconomic assessments and reports during the 1982-84 time period. A listing and submission date of these reports is shown below:

Financial Impact Statement and Alleviation Plan, October 1982

An Assessment of Public Costs and Revenues Resulting From the White River Shale Project, January 1983

Housing Master Plan, July 1983

Socioeconomic Monitoring Report, Quarterly Since July 1982

11.5.3 Impact Assessment

All of the studies listed in Section 6.5.2 have dealt exclusively with assessing and identifying the socioeconomic impacts of the White River Shale Project.

WRSOC and the WRSP owners, Phillips Petroleum, Sun Shale Oil Company, and Sohio Shale Oil Company, have continually maintained and demonstrated a noteworthy commitment to provide local and state governments with current information about the project. Since 1974, three different socioeconomic impact assessment documents have been prepared and distributed to governmental agencies. Changes in scope, schedule or technology have necessitated the publication of these different impact assessments.

In October of 1982, the White River Shale Oil Corporation submitted to the state of Utah and local governments in northeastern Utah and western Colorado a document entitled, White River Shale Project Financial Impact Statement and Alleviation Plan. The document was submitted to satisfy the requirements of Utah Code 63-51-10, commonly referred to as SB 170. The statute requires that "major developers shall file with the department

of community and economic development and all units of local government...a financial impact statement and a plan for alleviating these impacts".

The Financial Impact Statement and Alleviation Plan describes the project location, shows manpower estimates for the years 1983-2000, and projects population increases and residential distribution. The document provides a description of existing conditions with regard to water and wastewater disposal systems, school facilities, public health facilities, general housing conditions, and human services systems. A main component of the document is a discussion of the impact that the WRSP population would have on this existing infrastructure. It should be noted that WRSOC was the first industrial interest to provide an SB 170 submittal to the State of Utah.

In January, 1983, WRSOC submitted for review and comment to local governments an assessment of fiscal impacts that the project would have on public entities in the region. Basic data on expenditures and revenues, capital facilities and capacities, and service levels were obtained from local entities. Projections for population, public revenues and expenditures, and capital expansion were then developed from the baseline data and used in identifying fiscal impacts on the local governments.

A year-by-year analysis was completed for each of the public entities in the Ashley Valley, showing projected revenues and expenditures.

The results of the assessment indicated that all entities would have a long-term positive impact from development of the WRSP. Some, particularly the school district, would experience a short-term revenue timing problem during the early years of construction. Once, however, construction at the site neared completion, property tax revenues from the property tax were in excess of necessary capital expenditures.

11.5.4 Mitigation

The most significant impact mitigation-related event during the 1982-84 time period was the receipt and expenditure of U-a and U-b bonus money by the State of Utah. Significant amounts of the bonus funds were authorized for expenditure in Uintah County.

In January, 1982, the State of Utah received its share of the U-a and U-b bonus money. Utah received 37.5% of the total $124 million, or approximately $49 million. The three owner companies, Phillips, Sun and Sohio, paid $74 million as the first three installments of the total bid of $120.9 million in 1974, 1975 and 1976. Because of title questions, however, the funds had been retained in an escrow account until their release in December of 1981 at which time they totalled $124 million due to accumulated interest.

A task force appointed by Utah Governor Scott M. Matheson considered how best to expend the funds. After several meetings, a recommendation was made to allocate the money to the State Community Impact Board, where it would be provided to energy-impacted communities in the form of low-interest loans. The Utah Legislature, in a Special Session on June 17-18, 1982, appropriated $35 million to the State Community Impact Board for low-interest loans and authorized $25 million for expenditures. The additional $10 million was authorized for expenditures by the Impact Board in a Special Session in December, 1982. The remaining $15 million was appropriated during the 1983 General Session of the Utah Legislature to the General Fund.

Public entities in Uintah County have received the following amounts of bonus money:

Uintah County	$ 300,000
Vernal City	1,798,000
Ashley Valley Water and Sewer District	2,285,000
Maeser Water District	1,981,000
Jensen Water District	800,000
Ashley Valley Sewer Management Board	978,500
Uintah County School District	4,300,000
TOTAL	$12,442,500

All of the above awards were provided in the form of low-interest loans.

Other funds in the form of grants from the Community Impact Board have also been allocated to Uintah County entities. Significantly more than the $12.4 million shown above has been spent on community infrastructure since March 1982.

Prior to the road construction and mine development activity, a number of meetings were held with local officials to discuss mitigation programs. The housing of temporary construction workers surfaced as the main area of concern. The RV area discussed in Section 11.3 was designed and constructed for use by temporary workers, while the oversupply of existing housing in the Vernal area (also discussed in Section 11.3) was determined to be the best solution for housing relocating workers.

Discussions and planning activities with local governments for the surface construction workforce (post 1986) are underway.

11.6 Community Relations

11.6.1 Project Site Tours

Between March, 1982 and March, 1984, 584 people had been given a formal tour of the White River Shale Project. All tours have included above-ground facilities and many included the underground mine development which was underway during those two years.

Tours have also been given to staff employees from the three owner companies, Phillips Petroleum Company, Sohio Shale Oil Company and Sun Shale Oil Company. Other visitors have included government employees who have regulatory duties on the federal tracts. Both of the groups were not included in the 584 total. All groups who asked to tour the project were granted their requests.

11.6.2 Presentations

Interest in a pioneer energy development often results in requests for formal presentations, most often in the area most affected, the Uinta Basin.

Occasionally company officials give speeches or slide presentations in other parts of the country, but this report reviews formal presentations that have been given during the past two years in the Uinta Basin area of Utah and neighboring Colorado.

Most presentations have used an extensive slide library in the Vernal, Utah office and were given by the Manager of Community Relations. Slides were selected according to the specific interests of the group viewing them. Questions were addressed either during the presentation or at its conclusion. When available, pertinent literature was often made available to the group as well as oil shale samples and processing demonstrations.

Less formal presentations are given to the public when oil shale activity is the subject of daily two-minute radio broadcasts, the Energy Report, produced by WRSOC's Vernal office.

A formal slide presentation with recorded narration is available to the public when requested.

11.6.3 Contributions

Because communities are made up of all the groups living in the area, we did combine business and individual resources to improve them. WRSOC has tried to do its part in many ways.

WRSOC employees are involved in several local community organizations, chief of which is probably the Vernal Area Chamber of Commerce. WRSOC has two directors and one committee chairman serving with the Chamber, as well as contributing to dues and special Chamber activities during the year.

One of our mining engineers was the largest pledge collector in a recent fund raiser for a small boy needing a liver transplant. Other employees are volunteering time to the Boy Scouts of America and our local schools. The schools also benefit through the receipt of an excellent science film services, lectures, and loaned equipment.

Monetary contributions are another form of giving that pays dividends to the state and local community and the company. Over $20,000 was contributed during the reporting period to state and local organizations.

12.0 HUMAN RESOURCES ACTIVITIES

12.1 Recruitment

During 1982, WRSOC continued its recruitment activity, organizing a group of highly qualified management, professional, and administrative personnel to effectively meet project management and corporate responsibilities.

On December 31, 1982, WRSOC had a staff of 36 employees, an increase of 22 during the year. In December 1983, WRSOC reached a staff complement of 42, an increase of six as compared to December 1982. All authorized vacancies were filled in a timely manner with highly qualified personnel from the Owner companies or by outside hire. By February 29, 1984, total staff was reduced to 40 as a result of voluntary terminations.

WRSOC's goal has been to maintain a "lean" workforce while ensuring adequate manpower to effectively control and manage project responsibilities and expenditures through project completion and on-going sustained operation. Through March 1, 1984, the existing organization provided the WRSP with quality professionals to effectively and efficiently manage near-term Phase I project requirements, including design, engineering, construction, operation, and administrative responsibilities.

12.2 Human Resources Planning

During 1982, preliminary Human Resource planning was completed in contemplation of developing a detailed 5-Year Human Resource Plan that will outline Human Resource requirements through Phase I construction and operation. This preliminary data will eventually be utilized to prepare a comprehensive 5-Year Human Resource Plan. The contacts that have been established with reputable consultants, educators, business officials, oil shale and mining Human Resource personnel, and Owner company Human Resource personnel will eventually be utilized to enhance this planning effort.

WHITE RIVER SHALE PROJECT

Development of Federal Leases Ua and Ub
Statement of Expenditures
Period from March 1, 1982 through February 29, 1984
(Dollars in Thousands)

Construction Engineering		$13,955
Site Construction:		
Site Grading/Roads	$ 7,930	
Buildings	1,586	
Utilities	2,275	
Run-Off Retention Dam	3,609	
Mine Development	15,768	
Construction Support	1,584	32,752
Process Development/Engineering		6,193
Environmental Monitoring		2,013
Other Programs		502
General and Administrative Costs		8,278
TOTAL (3/1/82 - 2/29/84)		$63,693*

* Includes $60,191,078 in approved bonus credits.